...T, DECEMBER 31, 1936 FIRST AERO WEEKLY IN THE WORLD REGD. AT THE G.P.O. AS A NEWSPAPER

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FLIGHT

The AIRCRAFT ENGINEER AND AIRSHIPS

FIRST AERONAUTICAL WEEKLY IN THE WORLD : FOUNDED 1909

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A Satisfactory Year

HAPPY is the country, it is said, which has no history, but happier still is the historian who is able to write in December that the past twelve months have been an epoch-making year. That could not truthfully be said of A.D. 1936. It has been a year of continuous progress, rising in places to a fever of effort, but for the most part it has seen the fulfilment, or partial fulfilment, of decisions taken in 1935. In one respect the hopes expressed by *Flight* a year ago have not been fulfilled. Last January we wrote that if all went well the experimental flights by *Mercury*, the upper component of the Short-Mayo composite, would be made during 1936. These flights have not taken place; yet we have no intention of declaring that all has not gone well. Two of the Empire type boats, *Canopus* and *Centaurus*, and one of the Atlantic class, *Caledonia*, are now flying, and already they have proved their merits. The comfort provided in the Empire boats is of a standard never previously even considered in aeroplane, train, or coach.

The public is now more interested in flying than it has ever been since the days of Grahame White's race with Paulhan to Manchester. Its interests are divided between anxiety over air defence and enthusiasm for air transport. To consider the latter first, the most significant feature of the past year has been the way in which the *Hindenburg* has carried on the work begun by the *Graf Zeppelin* and has shown that well-designed airships manned by experienced crews are reliable transport aircraft. Naturally no aeroplane can rival the comfort offered by a large airship. Imperial Airways have continued to extend their lines farther and farther, and during the year *Dorado* took the first mails through to Hong Kong, passengers being carried on the service later, and *Dædalus* forged its way on from Kano to Lagos. Both of these extensions are matters of first-rate importance. Nearer home, British Continental Airways have been merged into British Airways, to the benefit, it is hoped, of both. The opening of Gatwick airport was an event of importance.

During the year a discussion has been in progress between the Home and the Commonwealth Governments on the details of the scheme for through running from England to Sydney and the surcharge of air mails. The matter has not been finally adjusted, but it is hoped that Australia has become reconciled to the use of flying boats between Darwin and Sydney, though she still apparently is standing out for a surcharge on air mail letters.

On the sporting side we had the Schlesinger race in the autumn, but the less said about that event the better. The *Pou du Ciel* has been tested in wind tunnels in France and England, and while M. Mignet has been justified, the probability is that few people in future will build *Poux* in their back yards.

R.A.F. Progress

Records are in a higher category than sport, and during the year the altitude record set up some time ago by the Italian, Commander Donati, was beaten by the French pilot Detré, who in his turn was surpassed by Sqn. Ldr. Swain in a Bristol monoplane. Britain thus holds one of the three most worthy records, with a height of 49,967 feet. We hope to do even better before long.

During the year the expansion of the R.A.F. has proceeded with energy, uninterrupted by crises in Africa. The Force has been reorganised into new Commands and Groups, and the term Area has been abandoned for the present. The Bomber Command, the Fighter Command, the Training Command, and the Coastal Command are now all under Air Officers Commanding-in-Chief, a rank previously held only by the A.O.C.-in-C. of the now defunct Command, Air Defence of Great Britain. The Shadow Industry has been

initiated to expedite the production of aircraft and engines, and to make provision for emergencies. A Volunteer Reserve has been announced, but has not yet been put into operation. Finally, a more practical and comfortable uniform has been sanctioned for the Force.

As regards organisation, important steps taken during the year have been the appointment of a Minister for Co-ordination of Defence and of a Director of Production at the Air Ministry. Sir Donald Banks has succeeded Sir Christopher Bullock as Permanent Secretary to the Air Ministry. The Royal Commission on the manufacture of arms has reported against a Government monopoly. The question of the Fleet Air Arm has been revived, and it seems likely that dual control on board naval ships will be abolished.

Technically, the most important developments of the year have been the appearance of the Short Empire flying boats, the Spitfire and Venom fighters, the medium bombers Battle, Blenheim, Hampden and Wellington, the heavy bombers Whitley and Harrow, and the army co-operation Lysander, as well as the designing of the autodynamic autogiro, which rises into the air with no forward run. Fuller accounts of the new types are given on page 693. The record for the year, on all counts, is certainly creditable.

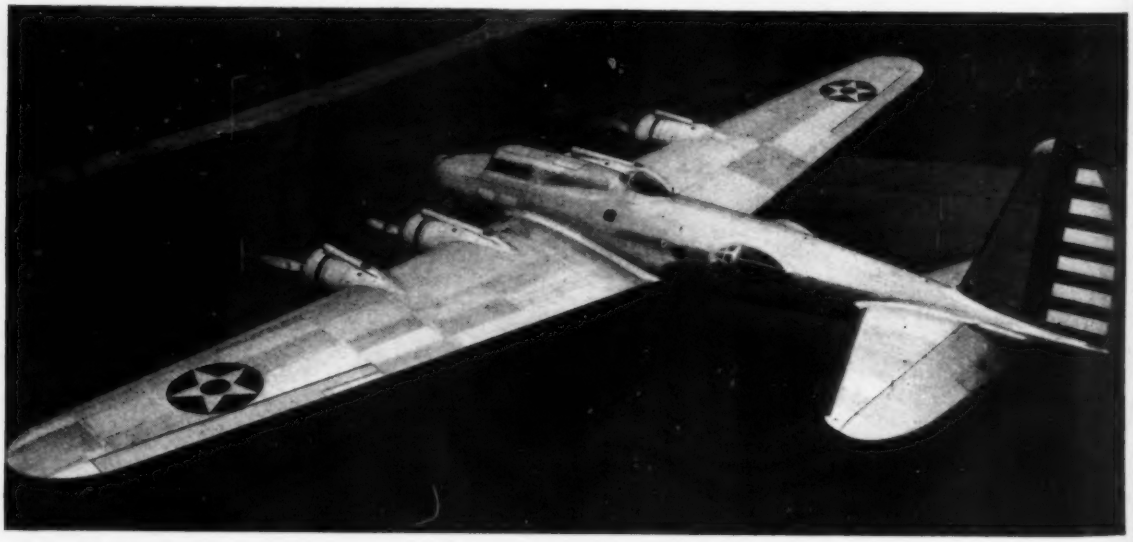
The Higher the Fewer

GREAT BRITAIN stands at the parting of the ways, and no man knows whither one branch of the fork may lead; the other is fairly familiar. Both are signposted, one legend reading "87 octane" and the other "100 octane." The almost phenomenal improvement in aircraft performance, particularly military aircraft performance, is due in some measure to cleaner aerodynamic design, but the bulk of the improvement has come from the engines, and that in turn is traceable very largely to the introduction of the 87-octane fuel, which has made possible a higher compression ratio and greater power output, particularly for take-off, and lower specific fuel consumption.

The undoubted success of the 87-octane fuel forms a natural and readily understandable foundation upon which to build even higher hopes if 100-octane fuel is introduced. The step, superficially so natural, is beset with difficulties which are not necessarily obvious. Specific power output is of primary importance, certainly, and one might well argue that it should be obtained at all costs. But technically there may be unsuspected difficulties. It seems that a 100-octane value cannot be obtained by the addition of the tetra-ethyl lead which has given us the 87-octane fuels, and that other means have to be adopted. What will the effect be on the engines? Will the higher output obtainable be off-set by shorter life and/or loss of reliability? And what of storage problems?

Several other questions need to be answered before one could embark with any technical confidence on the subject of the new fuels and all that their introduction would entail. But most important of all is, perhaps, the question of supplies in time of emergency. Once committed to the new fuels, the failure of supplies would "ground" large sections of the R.A.F. Engines designed to operate on 100-octane fuels would be all but useless on the present "87." Modifications would have to be made before they could be used. Tempting as are the prospects, it would be well to make sure, entirely and completely sure, that the necessary supplies can be guaranteed before taking a decision which may have the most profound consequences.

Should the decision be to go over to 100-octane fuels, the Diesel is doomed as far as military aircraft are concerned. Should the present "87" fuels be retained, it has a chance for certain types of aircraft. The fact that France and Germany are devoting a good deal of attention to the Diesel seems to indicate that they at least are not prepared to assume the final triumph of the petrol engine.



HEAT BLISTERS: The defensive armament of this Boeing YB-17 bomber, the first of thirteen for the U.S. Army Air Corps, is carried in a novel nose turret and four streamlined blister-like emplacements whence, so it is said, "the heat can be turned on" in practically all directions. The YB-17 is the largest landplane ever built in the U.S.A. and represents a class which has not so far featured in our own expansion programme. Four of the new Wright Cyclone "G" engines are fitted and a retractable undercarriage and tail wheel, flaps, v.p. airscrews, homing equipment, two-way R/T and an automatic pilot are specified.

The Outlook

A Running Commentary on Air Topics

All-in-one?

IS it possible to combine in one aircraft all the most desirable features of the aeroplane, the Autogiro and the helicopter? Mr. Peter Cameron, of Glasgow, believes it is, and on pp. 705-706 of this issue is described his design for a type of aircraft which he calls the Rotor Plane. Briefly explained, the Cameron machine is a combined fixed-wing and rotating-wing aircraft, the rotor blades of which can be expanded for take-off and contracted for high speed when the desired altitude has been reached. With the blades retracted and set at a small angle of incidence, the machine obtains most of its lift from the fixed wing, and as a retractable undercarriage can be used, the drag should be relatively low, so that high speeds should be attainable. Mr. Cameron has also evolved means for preventing the whole aircraft from rotating about its vertical axis when the rotor blades are being driven by the engine and the machine lifts as a helicopter.

That a number of technical difficulties and problems may be encountered in the evolution of the details of the mechanism will be granted, but the inventor has already prepared remedies for all the likely ones, such as the possibility of "binding" during the expanding or contracting of the blades, due to flexing of the rotor spars.

If the rotor plane is proved practicable it should have a great many advantages, and the high top speed expected plus the ability to hover as a helicopter invest it with obvious possibilities as a military aircraft.

This Freedom

THE fact that it is now open to receive applications for the posts of chief aircraft surveyor and chief aircraft engine surveyor has called attention to the almost forgotten Air Registration Board provided for in the Air Navigation Act passed last Session. This is the first practical and active signs of what the Government spokesmen are fond of calling "implementing" the recommendations of the Gorell Committee, itself almost forgotten by now, but appointed to examine the possibility of removing from the "deadening hand of Air Ministry influence" the design, construction and inspection of civil aircraft up to a certain size.

It is gathered that the Air Registration Board, about to be formed, is to set up the machinery necessary for taking over the work hitherto done by the Air Ministry of checking stress calculations, inspecting materials, overseeing maintenance, and so forth. The Board is to consist of groups, each group dealing with certain aspects.

Guaranteed

FLIGHT has examined the list of names of the representatives of constructors, operators and insurers serving on the different groups, and as these names are, almost without exception, household words in British aviation, one may accept that side of the A.R.B. as having been laid on a sound foundation.

Insurance seems to be the key to the whole matter, and as one of the groups includes four representatives of insurance companies it is to be assumed that these have expressed willingness to co-operate and to shoulder the by no means light burden.

We have always held the view that the aircraft manufacturer's regard for his own reputation is sufficient safeguard against inferior workmanship. The fact that an insurance company will have to take the risk of covering any aeroplane before it can fly will probably lead to a list of "approved" firms, as is the case now, only the insurance companies instead of the Air Ministry will do the approving. Any firm whose products do not meet with the approval of an insurance company will be in no position to market its machines.

The main stumbling block of the scheme is likely to be not of a technical but of a financial character. Although the A.R.B.'s organisation will not need to be quite as ambitious as that of the Air Ministry, it will have to be fairly extensive; this is also confirmed by the fact that the salary of the chief aircraft surveyor is to rise to a maximum of £2,000 per annum. Obviously he will have to have under him a staff of competent men, and the cost is likely to be not inconsiderable. Who is to pay? Presumably the manufacturer and the user will, between them, have to foot the bill. The manufacturer saves money by not being obliged to have Air Ministry inspection and supervision, and can thus afford to pay something towards the new scheme. The user, on the other hand, is already having to pay fairly heavily and is entitled to expect a reduction rather than an increase in cost, the more so as excessive cost was one of the criticisms levelled against the existing system.

The Boundary Layer

PROFESSOR MELVILL JONES has a wonderful gift of being able to explain in simple language the most complicated and abstruse problems. Never has this ability been better demonstrated than at his lecture on profile drag to the Royal Aeronautical Society shortly before Christmas. The lecture was quite different from the written paper, and thus both the "highbrows" and the "lowbrows" were able to benefit. Unfortunately, the paper is not one which lends itself to summarising, being already something of a summary, and for that reason it has not been considered expedient to deal with it in *Flight* this week. Perhaps, however, a brief reference to the main points and conclusions may serve to indicate what Professor Melvill Jones is "driving at."

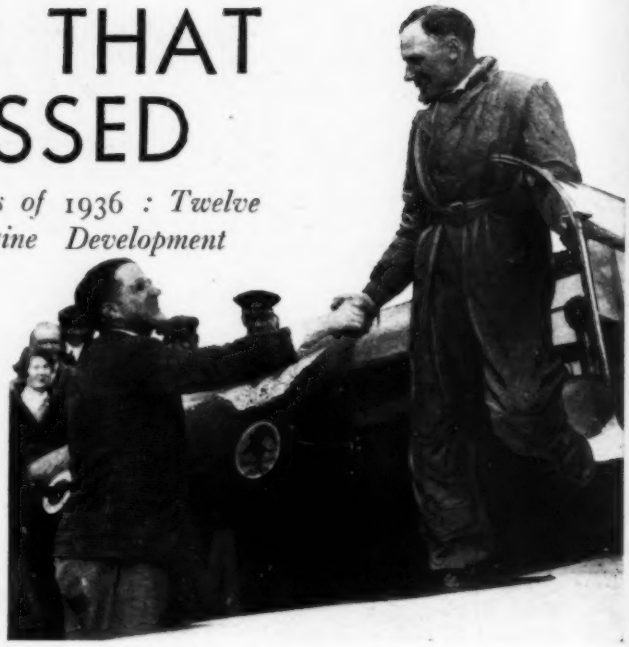
Profile drag, of wings of different thickness ratios, for example, is what it is required to know for practical design purposes, but its variations are difficult to understand unless the position on the wing profile where the flow in the boundary layer changes from laminar to turbulent is known, and the reasons which cause early or late changes. The "exploring" pitot tube is the modern means of detecting drag by indicating changes in pressure. The pressure in a pitot tube has a constant value at all points in the flow except in boundary layers and in the wakes which they create. When the pressures have been read or recorded, the profile drag can be deduced by a fairly simple calculation.

Professor Melvill Jones did not hold out hopes of any likelihood of great drag-savings by coaxing the boundary layer to remain laminar. Were this possible, the saving would be startling, but he thought it improbable that the laminar layer could be made to extend over more than one-third of the whole wing surface. This would represent a drag reduction of about 20 per cent. compared with a wing over which the layer was entirely turbulent

Surface roughness presents two problems: the effects of roughness on the point of transition and its effects on the skin friction applied by the turbulent boundary layer. Thus the lecture did not provide an answer to the problem of every designer about when it does and does not pay to go to the trouble and expense of flush rivets.

THE YEAR THAT HAS PASSED

Outstanding Flights and Events of 1936 : Twelve Months' Aircraft and Engine Development



Always taking a high place in the pursuit of the long-distance record—Flt. Lt. Tommy Rose and Mr. H. L. Brook.

AS we point out in our leading article, the aviation year which draws to its close to-day has been one of fulfilment rather than of initiation.

The Empire flying boats, conceived in 1935, are now going into service. The Royal Air Force expansion scheme, with its attendant repercussions on the aircraft industry, has got into full swing. The administration of the Royal Air Force itself has been reorganised. Important technical developments, tabled during 1935, have been brought to fruition.

Actual flying activity has proved as kaleidoscopic as ever. Outstanding, of course, is Sqn. Ldr. Swain's recovery for Britain of the world's aeroplane altitude record. The long-distance record breakers, too, have shown undiminished energy. The average man's recollection of such achievements is short, each new flight tending to eclipse its predecessors, so a study of the complete list, which follows, brings to light a surprisingly high total of both successful and unsuccessful attempts.

No less informative are the sections of this brief chronological review which deal with new aircraft and engine types and the year in the sphere of commercial aviation.

NOTABLE BRITISH FLIGHTS AND FLYING EVENTS

Thursday, February 6, 12.25 *a.m.*—Flt. Lt. Tommy Rose, flying a Miles Falcon with 200 h.p. Gipsy Six engine, the winning machine of the 1935 King's Cup Race, took off from Lympne aerodrome. He arrived at Capetown at 6.03 p.m. on the following Sunday. His time of 3 days 17 hrs. 38 mins. improved upon Mrs. Mollison's existing record by 13½ hours.

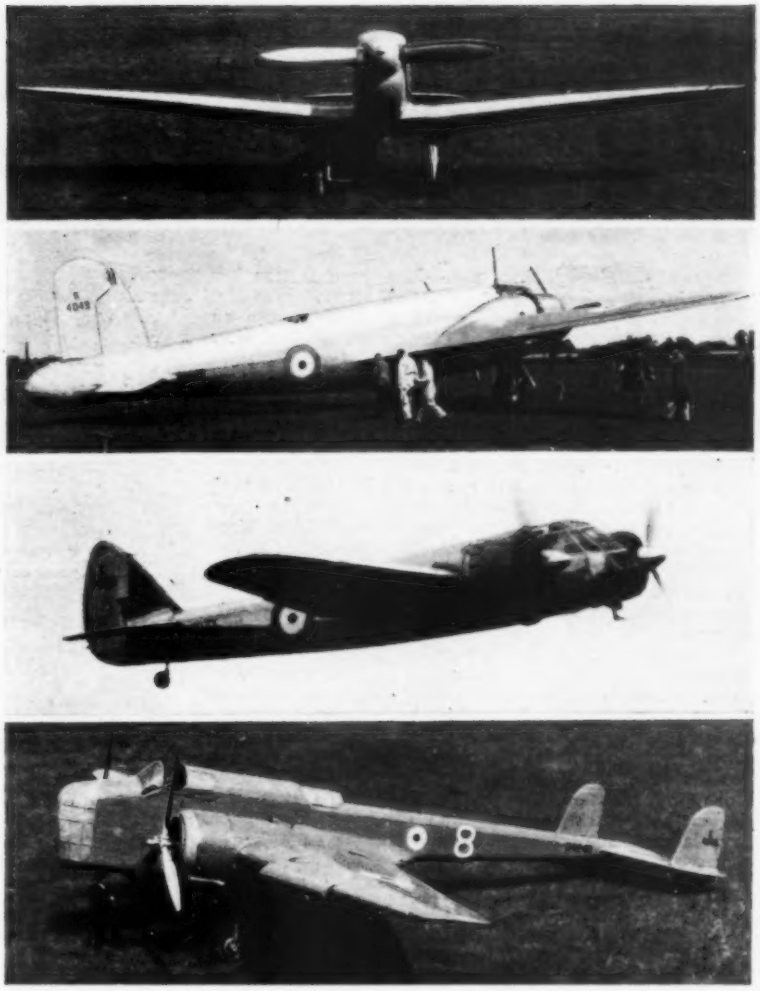
Friday, February 7.—F/O. Llewellyn took off from Lympne on an Aeronca with 40 h.p. J.A.P. engine, and, after giving numerous demonstrations *en route*, landed at Johannesburg on Sunday, March 1.

Tuesday, March 3, 4.08 *a.m.*—Flt. Lt. Tommy Rose left Capetown on the return journey to Croydon, where he landed at 11.05 a.m. on Monday, March 9, 6 days 6 hrs. 57 mins. later. The two journeys were thus completed in 10 days and 34 mins. The return journey did not constitute an official record, as the average speed for the whole distance was under 150 km./hr. (93.2 m.p.h.). The previous best time, 6 days 12 hrs. 3 mins., was made by F/O. David Llewellyn and Mrs. Jill Wyndham flying a Parnall Heck (Gipsy Six engine).

Monday, April 6.—The late C. J. Melrose left Heston for Australia on the first Heston Phœnix (Gipsy Six). Flying in comfortable stages via Karachi, Singapore, and Darwin, he completed the trip to Adelaide on April 29, on the sixteenth day out.

Monday, May 4, 9.05 *a.m.*—Mrs. Amy Mollison took off from Gravesend on a Percival Gull (Gipsy Six), and reached Capetown by the West Coast route at 3.31 p.m. on Thursday, May 7. Her time of 3 days 6 hrs. 26 mins. thus lowered the previous best time of Flt. Lt. Tommy Rose (who took the East route, which is 700 miles longer) by 11 hrs. 12 mins

Some of the most outstanding flights of the year have been made by members of the fair sex. Here are (left to right) Mrs. Mollison, Miss Jean Batten and Mrs. Beryl Markham, whose achievements are chronicled in this article.



Some outstanding military types of 1936: The Supermarine Spitfire, Vickers Wellington, Bristol Blenheim and Handley Page Hampden.

Wednesday, May 6.—Mr. H. L. Brook commenced his Cape flight on a Hillson Praga monoplane with two-cylinder 40 h.p. engine. He reached the Cape in 16 days 4½ hrs., after flying 135 hrs. in all at an average speed of 70 m.p.h. The fuel consumption was 30 miles per gallon.

Sunday May 10, 9.19 *p.m.*—Mrs. Mollison left Capetown on the return journey by the East route to Croydon. She landed at 1.36 p.m. on Friday, May 15, her time being 4 days 16 hrs. 17 mins., or 1 day 14 hrs. 40 mins. better than the time of Flt. Lt. Tommy Rose.

Saturday, May 30, 7.35 *a.m.* (local time).—Sqn. Ldr. Hilton left Capetown flying an Airspeed Envoy with two Wolseley engines. He was later held up at Athens before proceeding to Croydon, and so lost the chance of beating the best time from the Cape.

In the early summer a fourteen-thousand-mile survey flight made by W. R. Brett on the Shell Percival Gull was successfully terminated.

During *June, July* and *August* there was a lull in long-distance "speed flights," but flying people generally were intensely busy. Clubs at Hanworth, Reading, Eastbourne, and other centres arranged their summer "at-homes" or garden parties, and the Royal Aero Club organised the International Week-End Aerien. Gatwick, Perth, and the Brighton, Hove, and Worthing airports appeared on the list for the first time, the two first-named being officially opened by the Secretary of State for Air, Lord Swinton, who flew from Perth to Gatwick for the second ceremony.

Charles Gardner won the King's Cup Race at 164.5 m.p.h. on a Percival Vega Gull.

S. T. Lowe was successful in the modified Isle of Wight race, winning at 125.5 m.p.h. on a Comper Swift; and W. Humble came first in his Hawk Speed Six in the London to Newcastle race. Preparations were well under way for the Schlesinger England-South Africa Race.

The annual Hendon R.A.F. display took place on June 27, and the S.B.A.C. show was at Hatfield on the following Monday.

Friday, September 4, 6.50 *p.m.*—Mrs. Beryl Markham took off from Abingdon aerodrome, and after twenty hours of bad weather she landed, with fuel low, at Baleine Cove, Cape Breton Island. At almost the same time, leaving the Floyd Bennet airport on Wednesday, September 2, at 9.37 a.m., Harry Richman and Dick Merrill flew the Atlantic to Croydon (after landing in Wales) in an American Vultee with Wright Cyclone engine in 18 hrs. These flights give comparisons of time and engine power. The Cyclone develops about 1,000 h.p. for take off, using 100-octane fuel, and the Gipsy Six 200 h.p.

Tuesday, September 29.—C. W. A. Scott and Giles Guthrie started in the Schlesinger Race and flew to Johannesburg in 2 days 4 hrs. 57 mins., at once winning the race and setting up best time for the journey. The aircraft was a Percival Vega Gull with

That long-distance record-breaking is no joke is proved by this photograph of Mollison and Corniglion-Molignier absolutely "done" after their Cape flight.

200 h.p. D.H. Gipsy Six Series II engine fitted with V.P. airscrew.

A long-distance flight made during the late summer had a somewhat chequered progress. Lord Sempill, Mr. H. Wood and a crew of two left Hanworth in the Monospar Croydon with the intention of making a fast demonstration flight to Australia, but a damaged tail, due to a heavy landing, delayed them for many weeks in India. The machine eventually reached its goal, making good flying times, but the homeward journey ended in its abandonment on a Timor Sea coral reef owing to navigational difficulties.

Monday, October 5, 4.10 a.m.—Miss Jean Batten left Lympne aerodrome on her Percival Gull for Australia and New Zealand. Miss Batten arrived at Port Darwin on Sunday morning at 1.13 a.m., 5 days 21 hrs. 3 mins. after leaving England, thus beating H. F. Broadbent's existing time by 24 hrs. 16 mins. After a few days' rest the flight to Auckland, New Zealand, was completed on October 16 from Richmond, Sydney, in one 1,200-mile, 8½-hr. record "hop" over the Tasman Sea. The overall time from England was 11 days 1 hr. 25 mins.

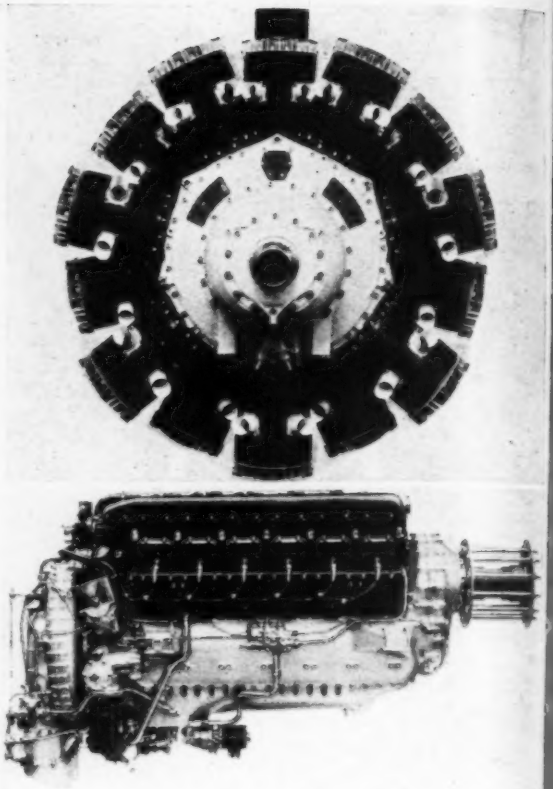
Thursday, October 29, 8.40 p.m.—Mr. Jim Mollison took off from Harbour Grace, Newfoundland, in his American Bellanca monoplane with Pratt and Whitney Twin Wasp Junior engine. At 9.57 a.m. on Friday morning he landed at Croydon, having crossed the Atlantic in 13 hrs. 17 mins. The coast-to-coast time was under 10 hours and was flown at an average height and speed of 15,000 ft. and 220 m.p.h. respectively.

In summing up we see that during the last year Great Britain has been in the forefront in capturing useful records. The altitude record set up by Sqn. Ldr. Swain indicates a considerable advance in engine design and supercharging. Civil flying has been greatly helped by the demonstrations of reliability of private types. Flt. Lt. Tommy Rose, Mr. C. W. A. Scott and Mr. Giles Guthrie, Mrs. Amy Mollison, Mr. H. F. Broadbent, Miss Jean Batten, Mrs. Markham, Mr. Ernle Clark—all these pilots have lately achieved an outstanding flight on a British civil aeroplane.

CIVIL AIRCRAFT DEVELOPMENTS IN 1936

THE year that is past has seen signs of resuscitation in the "ultra-light" aeroplane movement, although its re-awakening has not been assisted by calamities among *Pou* enthusiasts.

New "babies" have blessed the light aircraft market with quite remarkable frequency; additions during the past twelve months have included the Abbot-Baynes Cantilever *Pou*, Luton Minor and Buzzard, the Flittermouse, Kitten and Pup of Dart Aircraft, the Chilton monoplane, Hillson Praga, Tipsy and Brawny. One or two of these models have not flown at the time of writing, but are well on the way to completion.



Two of the most interesting British power units of 1936: (Top) the Bristol two-row sleeve-valve Hercules and (bottom) the liquid-cooled vee-twelve Rolls-Royce Merlin.

The added luxury and performance which comes with increase of price has been provided by the Percival Vega Gull, Miles Whitney Straight, a "square-tipped" version of the D.H. Hornet Moth, the Wicko monoplane with converted Ford car engine), the Cessna and Porterfield (two of a number of American importations), the C.L.W. Curlew, and the C.W. Cygnet. Nearly all these machines go far toward filling undesirable gaps in our range of civil aircraft.

Higher up the scale of size and price, the D.H. Dragonfly, B.A. Double Eagle, and Miles Peregrine are three particularly welcome models, demonstrative of the efficiency obtainable in comparatively small twin-engined types. That multi-engines may find favour much further toward the end of the price list is indicated by the success

LONG-DISTANCE RECORDS SUMMARISED.

Date.	Flight.	Country.	Pilot(s).	Aircraft and Engine.	Record or fastest time.	Remarks.
Oct. 20, 1934	England to Australia	G.B. ...	C. W. A. Scott and T. Campbell Black	D. H. Comet 2 Gipsy Six R.	2 days 23 hrs. 18 secs.	MacRobertson Race.
Oct. 20 to Nov. 2, 1934.	England to Australia to England.	G.B. ...	Lt. Cathcart Jones and Ken Waller.	D.H. Comet 2 Gipsy Six R.	13 days 12 hrs. ...	Mildenhall to Melbourne to Lympne.
Nov. 11, 1935	South Atlantic ...	N.Z. G.B.	Miss Jean Batten ...	Percival Gull Gipsy Six	13 hrs. 15 mins. ...	Thies to Brazil.
May 4, 1936...	England to Cape ...	G.B. ...	Mrs. Amy Mollison...	Percival Gull Gipsy Six	3 days 6 hrs. 26 mins.	F.A.I. Capital to Capital record.
May 4 to May 10, 1936.	England to Cape to England.	G.B. ...	Mrs. Amy Mollison...	Percival Gull Gipsy Six	7 days 22 hrs. 30 mins.	Fastest time to Cape and back.
Sept. 4, 1936...	Atlantic	G.B. ...	Mrs. Beryl Markham	Percival Vega Gull Gipsy Six	20 hrs.	Fastest solo feminine time.
Sept. 29, 1936	England to South Africa.	G.B. ...	C. W. A. Scott and Giles Guthrie.	Percival Vega Gull Gipsy Six Series II	2 days 4 hrs. 56 mins.	Schlesinger Race.
Oct. 5, 1936...	England to Australia	N.Z. G.B.	Miss Jean Batten ...	Percival Gull Gipsy Six	5 days 21 hrs. 3 mins.	Feminine and Solo records.
Oct. 5, 1936...	England to New Zealand.	N.Z. G.B.	Miss Jean Batten ...	Percival Gull Gipsy Six	11 days 1 hr. 25 mins.	Feminine and Solo records.
Oct. 16, 1936...	Tasman Sea ...	N.Z. G.B.	Miss Jean Batten ...	Percival Gull Gipsy Six	8 hrs. 30 mins ...	Fastest solo crossing.
Oct. 29, 1936...	Atlantic	G.B. U.S.A.	Mr. Jim Mollison ...	Bellanca Pratt and Whitney	13 hrs. 17 mins. ...	Fastest solo crossing.

of the fascinating little Hordern-Richmond Autoplane.

No one can truthfully say that 1936 was a vintage year for large British commercial aeroplanes. The industry may be thankful that the magnificent Short Empire flying boats have proved so uncompromisingly efficient. In their admiration of these craft foreign critics have passed more easily over our meagre offering of new transport types. Airspeeds are to be complimented on having further developed their Envoy model, while De Havillands have increased the usefulness of their "86" series. Bristols, in their Aquila-engined 143, have a promising "line." The loss of the prototype of the Monospar Croydan was a cruel blow to General Aircraft, who have, incidentally, brought their smaller S.T. 25 series to an even higher pitch of refinement.

The advances made with "direct-lift" Autogiros have been distinctly encouraging, and it should not be long before such machines will be regarded no more as experimental.

THE YEAR'S MILITARY AIRCRAFT

THE adoption of completely modern methods of construction and further aerodynamic refinement, coupled with the use of the most advanced, high-powered aero-engines in the world, has given us, during the past year, the finest military prototypes in existence. The great majority of these machines have been ordered in quantity for the equipment of R.A.F. squadrons.

In the fighter category the Hawker Hurricane, which actually appeared in 1935, has done well over 200 hours' flying and intensive testing, while the rather newer Supermarine Spitfire has been putting up some quite astounding performances, and has established itself as the world's fastest military aeroplane.

The Vickers Venom is interesting not only because it is much smaller and lighter than current competitors, but because it mounts a fully supercharged Bristol Aquila sleeve-valve radial.

Certain army co-operation units will shortly be receiving the Hawker Hector biplane with Napier Dagger medium-supercharged "H"-type engine. An even more highly developed model for "A.C." work is the Westland Lysander gull-wing monoplane with 800 h.p. sleeve-valve Perseus.

In the Bristol Blenheim we have, without a doubt, the fastest twin-engined bomber in production. It is doubtful, in fact, if any foreign prototype can show a more impressive performance sheet.

The single-engined Fairey Battle (Rolls-Royce Merlin) has undergone development, and has been joined by an Armstrong-Whitworth machine with a Tiger engine equipped with a two-stage supercharger.

Larger machines, but still classed as medium bombers, are the Pegasus-powered Handley Page Hampden and the Vickers Wellington, the latter of geodetic construction.

Two heavy bombers are already in large-scale production, and should be in commission before many months have passed. The types concerned are the Armstrong-Whitworth Whitley (two Siddeley Tiger) and the Handley Page Harrow, production models of which will be fitted with the Bristol Pegasus X and XX engines.

These excellent bombing types will go far toward relieving the national anxiety consequent on our slackening of the pace of bomber development in the past few years.

ENGINES OF 1936

IN view of the expansion programme and the need for higher-powered units, the development of aero engines during this year has been along the lines expected. New engines cannot be designed and tested in a day, or even in six months, the majority at the present time being fitted to production aircraft, therefore tend to be proven types with modifications and re-ratings. Next year should see the new engines in full production.

A new type to come into production is the Rolls-Royce Merlin of 1,065 h.p., which is now being installed in the Spitfire, Battle and Hurricane. This is the only new vee-twelve water-cooled engine, but Air Ministry orders for Kestrel engines have still to be completed, and it is understood that a few large civil types are to be powered by Kestrel XVIs, including the Ju. 86 for South Africa and the British Burnelli.

The Bristol nine-cylinder radials have been still further improved in power output, and Pegasus X, XC and XX give respectively 915, 830 and 925 h.p. maximum, the rated altitudes being 4,000, 4,500 and 8,500ft. Mercury VIII's and IX's, giving 795-825 h.p. at 13,000ft. are fitted to Gladiators and Blenheims. The sleeve-valve Aquila and Perseus range have a very important addition in the 18-cylinder, two-row Hercules, for which no performance data are as yet available.

Production Westland Lysanders are to have Perseus engines, and certain Short Empire boats are to have the civil-rated form, giving 640-665 h.p. Further developments are to be expected in the sleeve-valve field, which is indigenous to this country.

The moderately supercharged Armstrong Siddeley Tiger IX, giving 805 h.p. maximum, is being fitted to the A.W. Whitley twin-engined bomber. A newer development, the Tiger VIII, has a two-stage supercharger.

The Napier Dagger 24-cylinder air-cooled H-type engine, as fitted to the Hawker Hector, is a most advanced unit in design, and is the only one of its type. At the present time its weight is 1,305 lb. for 805 h.p. But this seemingly high weight/power ratio and the rather large frontal area may be compensated by the low cooling drag.

Alvis engines of two-row, fourteen- or eighteen-cylinder radial arrangement are under construction, and the licence to build the new small-diameter Gnome Rhône 14M. and the 18L. is held by the company.

In the civil sphere, the Gipsy Six Series II is a new development, and the geared and supercharged Gipsy Twelve now undergoing tests is reported to give over 500 h.p.

The Weir and Villiers Hay Maya, both four-cylinder-in-line, inverted, air-cooled engines, are additions to the light market; they have a maximum output of 50 and 130 h.p. respectively.

The Niagara III and Cataract III are the latest form of the Pobjoy firm's compact little radials; the later engine is, in effect, a derated Niagara III giving 88 h.p. maximum as compared with 95 h.p.

Phillips and Powis have for some months held the licence to build Menasco Pirate and Buccaneer engines in both normal and supercharged forms. Quite shortly may be seen supercharged engines of inverted vee and two-row radial types installed in private aeroplanes.

THE YEAR IN AIR TRANSPORT

AS far as air transport is concerned, 1936 has been a year of great plans rather than of great accomplishments, though the plans have, in themselves, been accomplishments of which the fruit will appear in 1937 and 1938.

In the meantime, Imperial Airways have opened extensions to Kano and Lagos *via* Khartoum, and to Hong Kong *via* Penang. These services opened for mail in February and March respectively (the former to Kano only), and the latter service is now carrying passengers. In March, too, South African Airways took over the Johannesburg-Capetown section of the African route; when, this summer, Imperial Airways are using boats over this route the terminus will be Durban. In May the duplication on the Australian service was completed when Qantas Empire Airways started a twice-weekly service between Singapore and Brisbane. Two months later the Transatlantic plans were officially announced, and the first of the Short Empire boats made its maiden flight at Rochester. The history and the future possibilities of Atlantic services were fully dealt with in last week's issue.

Not less important in their own sphere have been the

operations of British Continental Airways and British Airways, two companies which have since amalgamated, though this amalgamation does not appear yet to be absolutely settled. In July the first service to be subsidised, other than those of Imperial Airways, was started when British Airways opened their somewhat ill-fated Scandinavian night mail, and in the same month the North Sea service from Liverpool to Amsterdam, *via* Doncaster, was reopened with pooled operations by K.L.M. and B.C.A.

The year has been primarily interesting in the matter of the increased use of radio navigation. Blind approach beacons have been installed at Heston, Croydon and Gatwick, and there has been an extension in the scheme for controlled areas. Next year will probably see the completion of a plan covering the British Isles. The internal services and the increases in the number of radio stations were dealt with in a special article which appeared in the issue of November 5, 1936.

Fairey Progress

THE accounts of the Fairey Aviation Company for the year ended September 30 show increased earnings, the net profits of £60,176 representing a £21,064 increase.

The balance-sheet indicates notable progress. For example, the value of stock, work in progress, etc., has risen from £291,000 to £544,000, and sums due by debtors from £45,000 to £247,000. The most striking item in the balance-sheet, however, is the increase in the amounts due by subsidiaries, the total of which is £729,000, against £31,000 a year ago.

Competitive Aluminium Finishes

FOR the purpose of extending the fields of application of aluminium and its alloys, a competition has been inaugurated by the Bureau International des Applications de L'Aluminium, of 23 bis, rue de Balzac, Paris (8e) France. The competition is open to inventors in all countries and is designed to encourage researches into the chemical production of surface coatings and aluminium and its alloys. Protection processes by lacquers, varnishes, paints, waxes or similar applied coatings are not covered by the competition. The qualities required for the coating are, in order of importance:—(*a*) a high degree of protection against attack by natural agents or chemical reagents; (*b*) that it should be as transparent and colourless as possible, but capable of being coloured when required; (*c*) that it be smooth to the touch and must not readily show finger marks.

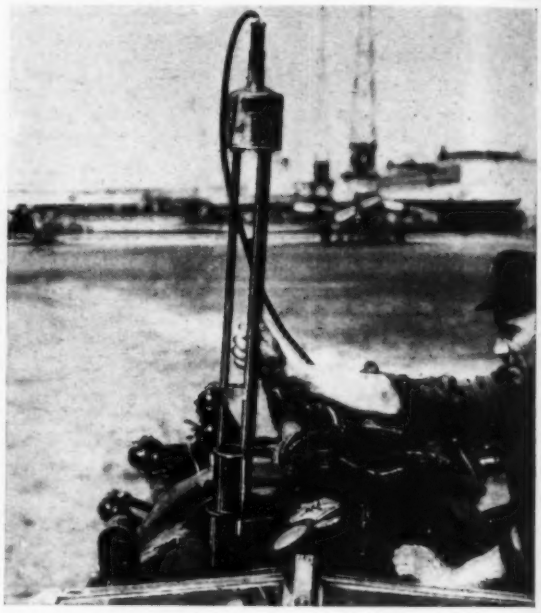
Inventors' samples should be sent to the above address by registered post not later than June 1, 1937. An International jury will appoint the examination of the samples according to the rules laid down in the pamphlet issued in this country by The British Aluminium Co., Ltd., Adelaide House, London, E.C.4. A prize of approximately £250 is offered to the successful candidate.

Pre-Heating Engine Oil

COLD-WEATHER starting difficulties can be largely obviated, and running-up periods shortened, if provision is made for pre-heating the oil. There is no simpler way of doing this than by using an electric immersion heater, and such a unit, specially designed for the purpose, has been placed on the market by Eltron (London), Ltd., Salisbury Square House, London, E.C.4, who are manufacturers of domestic water heaters.

The heater (which is covered by British patents) has ring-type elements, enclosed in a casing of convenient shape for passing into the oil tank, and drawing their current from the aerodrome lighting or power supply.

A temperature feeler rod, with a small bi-metal circuit-breaker in the point, is fitted close to one of the elements. This switch, working in conjunction with a contactor in the head of the instrument, cuts off the supply current immediately the oil reaches the predetermined temperature, thus preventing carbonisation or cracking of the oil.



The Eltron oil heater, described in the accompanying paragraph, in use.

In the head of the instrument is a pilot lamp which lights up and gives warning when the instrument is on circuit.

The thermostat switch and connectors are all totally enclosed, so the heater can be used in a confined space containing oil and petrol gasses without risk of fire or explosion.

Most of the well-known aircraft constructors in Germany and Russia now make it a standard practice to provide oil tanks with openings of from 3in. to 4in. diameter, thus permitting electric oil heaters of this type to be used.

Forthcoming Events

January 8. R.Ae.S., I.P.T. and I.A.E. Joint Lecture: "High-duty Aero Engines and Fuels," by Mr. F. R. Banks. Royal Society of Arts, 5.30 p.m.

January 14. R.Ae.S. Lecture*: "Magnesium Alloys," by Dr. C. H. Desch.

January 19. R.Ae.S. Students' Section Lecture: "Critical Speeds of Monoplanes," by J. Hanson. R.Ae.S. Library, 7 p.m.

January 21. R.Ae.S (Coventry Branch) Lecture: "Air Route and Aerodrome Control," by L. A. Sweny. Armstrong Siddeley Canteen, 8.15 p.m.

January 20-22. Aerodrome Owners' Association: Airports Exhibition and Conference.

January 28. R.Ae.S. Lecture*: "Plastic Materials," by Dr. N. A. de Bruyne.

February 3. Royal United Service Institution Lecture: "The Anti-Aircraft Defence of Great Britain," by Maj.-Gen. R. H. D. Thompson.

February 5. Cinque Ports Flying Club: Annual Dinner and Dance.

February 10. Yorkshire Aviation Services Annual Dinner and Ball, 8 p.m., Grand Hotel, Harrogate.

February 11. R.Ae.S. Lecture*: "The Automatic Pilot," by Mr. F. W. Meredith and Mr. P. A. Cooke.

February 12. De Havilland Technical School Annual Dance, 9 p.m., Hyde Park Hotel, London, W.1.

February 17. Royal United Service Institution Lecture: "Air Force Co-operation in Policing the Empire," by Air Comdr. C. F. A. Portal.

February 18. R.Ae.S. Lecture*: "Possible Layouts for Air-cooled Engines," by Mr. A. H. R. Fedden.

February 18. Civil Aviation Service Corps: Dance, First Avenue Hotel, London.

February 25. R.Ae.S. Lecture*: "Power Measurements in the Air," by Mr. N. S. Muir.

February 26. Brooklands and Associated Clubs: Dinner and Dance, May Fair Hotel, London.

February 26. Hampshire Aeroplane Club: Annual Dinner and Dance, South-Western Hotel, Southampton.

March 11. R.Ae.S. Lecture*: "Airscrew Blade Vibration," by Major B. C. Carter.

April 8. R.Ae.S. Lecture*: "Control Problems," by Mr. A. G. Pugsley.

April 22. R.Ae.S. Lecture*: "Power Plant Trends," by Mr. G. J. Mead.

* These lectures take place at the Royal Society of Arts, 18, John St., London, W.C.2, at 6.30 p.m. Admission is by ticket obtainable through a member.

THE FOUR WINDS

ITEMS OF INTEREST FROM ALL QUARTERS

FLIGHT wishes to acknowledge a veritable avalanche of Christmas and New Year greetings received from business concerns and private readers in every quarter of the globe, and heartily reciprocates their sentiments.

The latest model Wright Cyclone, the G-100, is rated at 1,100 h.p. for take-off and has actually delivered 1,205 h.p. —all from nine cylinders.

A sum of £300,000 has been allotted by the Egyptian Minister of War in the Draft Budget for the purchase of twelve bombers from Great Britain.

Sir Philip Sassoon has stated in the House of Commons that, last year, fatal accidents in the German Air Force during training were ten times as numerous as in the R.A.F.

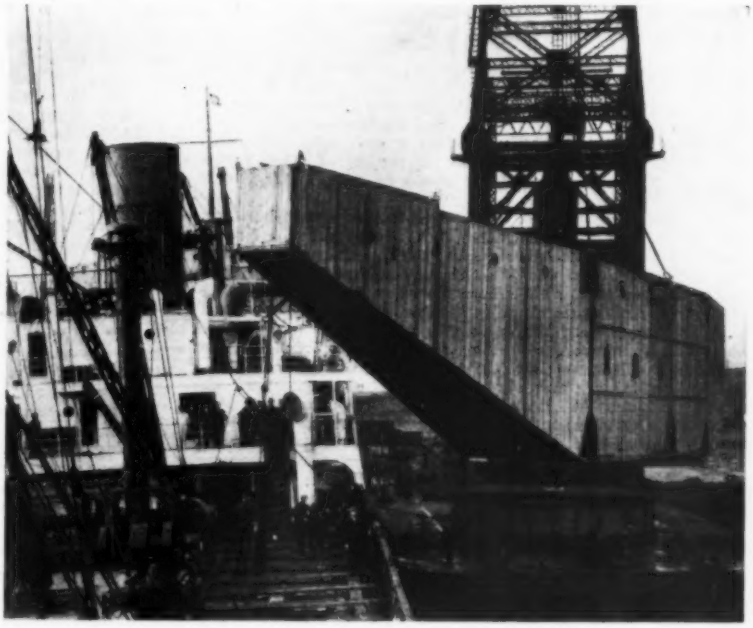
It is reported that the Marcel Bloch 160 (four 690 h.p. Hispano X), the new Makhonine with retractable outer wing panels, and the Amiot 341, exhibited at the last Paris Show, have been entered for the New York-Paris race.

Mlle. Maryse Hilsz, the French airwoman, dislocated her shoulder and injured five ribs when she fell out of her machine near Marseilles recently. It is believed that her injuries were caused by the sudden opening of her parachute, which carried her into a lake.

Twenty-five Years Ago

(From "Flight" of December 30, 1911.)

"While 1911 has been a good year for the aeroplane, it cannot be said that it has been equally kind to the big dirigible. While it is true that there have not been the same number of accidents to these unweildy craft to record that there were during the previous year, it is equally true that nothing like the same attention has been paid to the type . . ."



BERMUDA RIGGED. The hull of *Cavalier*, the Short Empire flying boat which will operate in conjunction with a machine of Pan-American Airways on the Bermuda-New York service, being hoisted, in what is said to be the world's largest packing case, aboard the S.S. *Loch Katrine*. The case follows the lines of the hull remarkably closely; if the bottom corners were "gouged" out the resemblance would be even more striking.

An unusually interesting light fighter biplane is being built by the French Romano company. Its wheels retract into the fuselage, it has gull-type upper wings, its span is about three feet shorter than its fuselage, and it mounts a 450 h.p. inverted-vee Renault. It should do 285 m.p.h. Cruising at 200 m.p.h. the range should be 500 miles.

Three Lockheed Electras have been delivered to the U.S. Army Air Corps for the "transportation of personnel." The Corps has lately ordered 120 mid-wing observation monoplanes from the North American Aviation Co., Inc. These machines have a retractable undercarriage and are powered with Cyclone G engines.

JUNKERS FOR THE NORTH: A batch of Junkers Ju.86 bombers have been ordered by the Swedish Government. The first machine was recently demonstrated at Bromma, near Stockholm, by Captain Soederberg. It is likely that the production machines will be fitted with Swedish-built Pegasus engines, or Mercuries as they are called in Sweden, for some baffling reason.

Correspondence

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases, accompany letters intended for publication in these columns.

KEEPING FAITH

YOU do well to suggest, on page 644 of the issue of December 17, the introduction of the Diesel engine, but does not every air disaster produce this reaction on those who have fully considered the subject? Re-introduction would be a more appropriate term, for it is but a few years since, in a lecture on the subject at the Royal Society of Arts, it was demonstrated that a petrol fire could be immediately extinguished with Diesel oil.

The Diesel engine was introduced to the air with a considerable amount of enthusiasm, but a very grave error was made by the engine builders, as, with perhaps one notable exception, they took the line of least resistance and converted petrol engines to Diesel. Even the exception to which I refer is, from the engineer's point of view, a makeshift or adaptation, though of considerable interim value. So we must take that panacea for so many evils, the clean sheet of paper, and pin it to the drawing board, if we are to succeed.

I do not agree, however, with the statement that the Diesel does not lend itself to momentary overloads for take-off, etc.; this is misleading. The aero engine is rated for a certain take-off load. This in the petrol engine is a momentarily attainable overload, while in the Diesel it is a load that can be maintained indefinitely. Are we to claim it a virtue in an engine that its maximum load cannot be sustained?

In the matter of output a two-stroke engine can give an indicated m.e.p. of 160 lb. with a slight amount of supercharge, while the whole problem of supercharge is greatly simplified.

A Diesel engine can be made with a weight of somewhat less than 1.75 lb. per standard h.p., which compares very well with the modern high-power petrol engine.

I do not like your suggestion that the Government should in due course compel civil aviation to use Diesels. The recipe for such an engine as is required is quite a simple one; it is on the lines of Mrs. Beeton's "Two quarts of cream, one pound of truffles," etc., but in this case it is: "Many, many clean sheets of paper, much money (to throw down the sink), enterprise, imagination, and the infinite capacity for taking pains." What the Government might do would be to supply the paper and the money in the form of a substantial reward and a small grant to anything of promise.

London, S.W.13. DESIDERATUM.

ATLANTIC PAY-LOAD PER HORSE-POWER

MR. GOUGE'S lecture on civil flying boats was notable for the number of solid facts which it contained; and some of those facts should be of particular interest to people who are looking forward to a commercial air service across the Atlantic. The figures given in the lecture show that when the range of the Short Empire boat is increased to about 3,000 miles, the pay-load decreases from 18½ per cent. of the all-up weight to 2½ per cent.

This is no reflection on the design of the boats, which are almost certainly the best of their kind in the world; but it does show that when the range of a heavier-than-air craft is increased to several times its normal value, the aircraft ceases to be a commercial proposition. We are, therefore, faced with the prospect of paying about seven times as much (per mile) on the Atlantic route as on an ordinary short-stage route. As there are a lot of miles on the Atlantic route, the passengers and/or the taxpayer are going to incur a great deal more expense than they can afford—unless we go about the business in a proper manner.

The most important point, from an airline operator's point of view, is the porportion of income to expenditure; and this depends very largely on the ratio of pay-load divided by horse-power. The Empire boat carries 2½ lb. of pay-load for every h.p.; the long-range version of this boat carries 5¼ *oz. per h.p.*

This rather discouraging piece of arithmetic would tend to show that we have no earthly (or should it be airy?) chance of achieving a truly commercial air service across the Atlantic, but for the fact that the airship *Hindenburg* carries 9 lb. of pay-load for every h.p. It is interesting to note that although the last two or three annual reports of Imperial Airways have referred to their preparations for an Atlantic service, there has been no indication, I believe, that they have ever considered the possibility of using airships.

There is not room in a letter to include all the important considerations involved in this subject, and I hope your readers will not assume that I have forgotten to observe them. Speed, for instance, is important; and although it will alter the relative figures a good deal, the fact still remains that the heavier-than-air craft is still vastly inferior in "commercial efficiency" to the airship over long-distance routes.

Walton-on-Thames. E. N. B. BENTLEY, A.F.R.Ae.S.

ULTRA-LIGHTS AND THE "VICIOUS CIRCLE"

I HAVE taken an unusual interest in the development of the ultra-light aeroplane for some years, and thus was much intrigued by your news in the December 10 issue of "Recruits for the Light Brigade."

My attention was immediately attracted to the layout of the Dart Flittermouse, as I have been working along lines identical to those of this design, but was unaware of this Dart development. I have great faith in this particular type.

I must say, however, how much I deplore the final statement which alleges:—

"The use of the 45.50 h.p. Weir engine would benefit take-off considerably. Incidentally, the company feels that this power plant may provide a brighter outlook for an economical two-seater with a really practical performance."

Whilst appreciating keenly in every sense the virtues of such measures, does not this one statement provide an indication of a cyclic return to early days (1920-25)? Why must this vicious circle be allowed to exist every time we get "safe" and "cheap" flying? I can see history repeating itself in this matter if manufacturers do not exert some will power at least.

Regarding "Indicator's" comments on ultra-light twin-engined jobs, I am still waiting to see some reference made to the Short "Cockle" flying boat of 1923. A single seater, she was persuaded along by a couple of vee-twin Blackburnes at 65 m.p.h.

Imagine the thrill and scope of touring the coasts of Great Britain in your own flying boat!

I have during the past owned the Supermarine "Sparrow" (two seater with "Cherub") and the Parnall "Pixie" (single seater with Blackburne), both in the ultra-light category, and am now designing my own.

Bedford. G. A. CHAMBERLAIN.

TAPERED WINGS

IN your issue of December 17 I have been taken to task by Dr. Lachmann for criticising the highly tapered trapezoidal wing, and I am now asked to present "rational reasons" for suggesting the elliptical plan form as a basic shape for high-scale research on tapered wings.

On the score of induced drag I have little quarrel with the figures quoted, except to point out that Glauert's induction factors are based upon the theoretical lift curve slope for a thin aerofoil in a perfect fluid. "This particular prophesy of aerodynamic behaviour is among the least successful of those for which the aerofoil theory is responsible" (I quote from Warner, 1936), and because the theoretical slope is not attained in practice the figures quoted for induced drag are about 10 per cent. too low. From the engineers standpoint I agree that the difference in performance is generally unimportant, but if Dr. Lachmann *will* quote from the old testament according to Glauert, he should tread more warily among the Glauertian slopes.

Dr. Lachmann's figures for profile drag are more open to vivisection. After "a careful analysis" of a Göttingen model test at a Reynolds number of 420,000 we are shown that the trapezoidal wing results in a lower profile drag than either the elliptical or the rectangular—which is rather unfortunate for the theory once more. Would Dr. Lachmann have us believe that the trapezoidal wing is superior to the elliptical in this

(*Concluded on p.* 706)

THE ROYAL AIR FORCE

SERVICE NOTES AND NEWS — AIR MINISTRY ANNOUNCEMENTS

CHANGE IN THE HIGHER COMMAND

The Air Ministry announces that Air Commodore Sydney William Smith, O.B.E., is to be Air Officer Commanding, No. 1 (Bomber) Group, on January 7th, 1937, vice Air Commodore Owen Tudor Boyd, O.B.E., M.C., A.F.C.

Air Comdre. S. W. Smith was seconded to the Royal Flying Corps from the Royal Artillery in September, 1914, and after a period of service in France was employed first as flying instructor and then in command of various training and other units at home. In August, 1919, he was granted a permanent commission in the Royal Air Force as a Squadron Leader and subsequently served in the Middle East and Iraq Commands, during which period he participated in the first transfer of a complete squadron by air from Egypt to Iraq. On return to this country in 1923, he took a two years' course at the Staff College, Camberley, and later served as chief air staff officer at Cranwell and on air staff duties at the Air Ministry until appointed, in 1929, to command the Royal Air Force Flying Boat Station at Cattewater (now Mount Batten). In 1931 he was appointed station commander at Manston and since October, 1933, has commanded the Royal Air Force in the Far East.

Air Comdre. Smith received the O.B.E. in 1919 for distinguished service during the Great War. He was promoted to Wing Commander in 1924, to Group Captain in 1931, and to his present rank in January, 1935.

The Halton Inspection: Air Marshal P. B. Joubert de la Ferté, C.B., C.M.G., D.S.O., passing down the ranks of aircraft apprentices of No. 1 School of Technical Training

Air Comdre. O. T. Boyd entered the Indian Army as a 2nd Lieutenant in 1909 and was attached to the Royal Flying Corps in 1916 after graduating at the Central Flying School. During the War he served in France and Mesopotamia and, for his services, he received the O.B.E., M.C., and A.F.C. Air Comdre. Boyd resigned his commission in the Indian Army in August, 1919, on being appointed to a permanent commission, as a Squadron Leader, in the Royal Air Force.

Both during the War and since he has held the command of various units. After a course at the Army Staff College, Camberley, he was appointed, in 1928, Instructor there in Air Staff Duties. He was subsequently appointed Deputy Director of Staff Duties at the Air Ministry and in 1931 proceeded to Aden as Officer Commanding, British Forces. After his return to England in 1934 he was employed as Senior Air Staff Officer, Fighting Area, Air Defence of Great Britain, until October, 1935, when he was appointed to command Central Area, which was renamed No. 1 (Bomber) Group, in May last. He was promoted to Wing Commander in 1923, to Group Captain in 1930, and to his present rank in July, 1934. He becomes Director of Personal Services at the Air Ministry.

HALTON INSPECTION

The following are extracts from the report by the Commandant, Royal Air Force Station, Halton, on the passing out of aircraft apprentices from No. 1 School of Technical Training (Apprentices) on December 21. The inspection was carried out by Air Marshal P. B. Joubert de la Ferté, C.B., C.M.G., D.S.O.

Of the 192 apprentices originally attested for Halton four were discharged as "unlikely to become efficient airmen," two were granted discharge by purchase, five were discharged on medical grounds, twelve were transferred *to* a junior entry, while ten were transferred to this entry *from* senior entries, leaving 179 to pass out from Halton.

The whole of these apprentices have been trained in the trade of Fitter II.

As a result of the final examinations ten aircraft apprentices have been classified as Leading Aircraftmen; 139 have been classified as Aircraftmen 1st Class, and twenty-four have been classified as Aircraftmen 2nd Class. Of the remainder four aircraft apprentices failed to qualify, whilst two were not examined owing to sickness.

AWARDS

Grand Aggregate:—1st prize, Gregory, E. W.; 2nd prize, Dunn, H. J. R.; 3rd prize, Jones, N. M.

Educational Subjects:—Craig, J.

1st Fitter II:—E. W. Gregory.

Elliott Memorial Prize:—Stead, J. C.

Cadetships:—Mould, P. W. O., Dunn, H. J. R., Winch, H. J., Stevens, B. O. C.

Viscount Wakefield Scholarship:—Dunn, H. J. R.

R.A.F COLLEGE INSPECTION

The following are extracts from the report of the Commandant of the Royal Air Force College, Cranwell, at the passing out inspection of Flight Cadets on December 18. The inspection was carried out by Air Marshal Sir Hugh Dowding, K.C.B., C.M.G.

Flight Cadets are to be given a course in an Advanced Training Squadron during their last two terms at the College. Part of this training will be done at an Armament Training Camp. In consequence of this change an Advanced Training Squadron has been formed.

The standard of instrument flying is satisfactory and the average amount of this flying completed by cadets of the VI Term is 10 hr. 24 min.

Night flying was started on October 16 and all Flight Cadets of the VI Term have received some night flying experience.

Two Flight Cadets have been withdrawn as they were unlikely to make satisfactory Service pilots

No serious flying accidents have occurred in the Flying Training Squadron this term. In the Advanced Training Squadron the only serious accident was a collision in the air which resulted in the death of the instructor. The Flight Cadet landed safely by parachute.

The Flight Cadets now passing out have flown an average of 73 hr. 50 min. dual and solo on Service types and 74 hr. 40 min. on Elementary types; making a total of 148 hr. 30 min.

During the period under review, 1.6.36 to 14.11.36, the total number of Flight Cadets admitted to hospital was thirty-one. The analysis of admissions to hospital, compared with those for the corresponding period of last year is: Flying, 1; motor car, 7; motor

cycle, nil; organised games, 4; miscellaneous illnesses, 17; miscellaneous accidents, 2.

AWARDS

His Majesty the King's Medal, presented to the Flight Cadet who obtains the highest aggregate of marks in all subjects in the final order of merit following the passing-out examination, has been awarded to:—

Flight Cadet Sgt. Cecil Dunn Milne.

The Sword of Honour, presented to the best all-round Flight Cadet in the Senior Term, has been awarded to:—

Flight Cadet Under-Officer Howard Frizelle Burton.

The Air Ministry prize, awarded to the Flight Cadet in the Senior Term obtaining the highest marks in the Imperial and War Studies, has been won by:—

Flight Cadet Roderick Hugh McConnell.

The Air Ministry Prize, awarded to Flight Cadet in the Senior Term obtaining the highest marks in Aeronautical Engineering, has been won by:—

Flight Cadet Sgt. Cecil Dunn Milne.

The Abdy Gerrard Fellowes Memorial Prize, for the Flight Cadet obtaining the highest marks in Mathematics and Science, has been awarded to:—

Flight Cadet Under-Officer Harry Emlyn Bufton.

The J. A. Chance Memorial Prize, for the Flight Cadet in the Senior Term obtaining the highest marks in Service Subjects, has been awarded to:—

Flight Cadet Sgt. Cecil Dunn Milne.

The R. M. Groves Memorial Prize, for the best all-round pilot in the Senior Term, has been awarded to:—

Flight Cadet Cpl. Louis Douglas Wilson.

NOMENCLATURE OF AIRCRAFT

The name of the De Havilland training aeroplane fitted with Gipsy XII engine is Don I.

AWARDS FOR GALLANTRY

The Air Ministry announces:—The King has been graciously pleased to approve the following awards to the undermentioned officers of the Royal Air Force for gallant and distinguished services rendered in connection with operations in Palestine, 1936:—

Distinguished Flying Cross

Flt. Lt. (now Sqn. Ldr.) Charles Herbert Tighe; F/O. Richard Godfrey Seys.

Military Cross

P/O. William Foulsham.

NEW SQUADRONS FORMED

No. 228 (Flying Boat) Squadron formed at Pembroke Dock on December 15 and has been placed under the command of the A.O.C.-in-C., Coastal Command.

No. 269 (General Reconnaissance) Squadron formed at Bircham Newton on December 7 and will move to Abbotsinch by January 1, 1937. The unit is being equipped with general reconnaissance aircraft and has been placed in the Coastal Command. It will be placed in No. 16 (Reconnaissance) Group with effect from January 1, 1937.

FORMATION OF STATION HEADQUARTERS

A station headquarters will form at Waddington on March 12, 1937, on which date the station will be transferred within the Bomber Command to No. 3 (Bomber) Group.

A station headquarters is to form at Dhibban on January 1.

MOVE OF A SQUADRON

No. 23 (Fighter) Squadron moved from Biggin Hill to Northolt on December 21.

A CHANGE OF TITLE

The title of the Coast Defence Development Unit has been changed to No. 1 Coast Artillery Co-operation Flight.

ROYAL AIR FORCE GAZETTE

London Gazette, December 23, 1936

General Duties Branch

Air Comdre. O. T. Boyd, O.B.E., M.C., A.F.C., is appointed Director of Personal Services, Air Ministry, vice Air Vice-Marshal J. E. A. Baldwin, D.S.O., O.B.E. (December 21); Flt. Lt. A. G. C. Somerhough is granted a permanent commission and is transferred to the Legal Branch on probation with effect from and with seniority of December 12; F/O. W. D. Woods is promoted to the rank of Flight Lieutenant, with effect from December 7 and with seniority of October 1; P/O. H. M. Starr is promoted to the rank of Flying Officer (October 16).

Medical Branch

Flt. Lt. J. H. Cullinan, M.R.C.S., L.R.C.P., is placed on the retired list at his own request (December 15); Flt. Lt. A. E. Vawser, L.M.S.S.A., is removed from the Royal Air Force (April 4).

Chaplains Branch

The Reverend E. C. Jones is granted a short service commission with the relative rank of Squadron Leader, with effect from and with seniority of December 12.

ROYAL AIR FORCE RESERVE

Reserve of Air Force Officers

General Duties Branch

The following are granted commissions as Pilot Officers in Class AA (December 22):—J. Blackburn, J. C. Newbery, C. N. Foxley Norris, T. S. Tull.

C. W. Martin is granted a commission as Flying Officer in Class B (December 22); Major W. A. C. Heyman (R.A.R.O.) is granted a commission as Flight Lieutenant in Class C (November 12); Sqn. Ldr. J. Kempar, M.B.E. (R.A.F. rtd.) is granted a commission as Flight Lieutenant (Hon. Squadron Leader) in Class C (November 2); F/O. W. Allan is granted a commission in that rank in Class C (December 22); P/O. E. B. Nelson is promoted to the rank of Flying Officer (November 17, 1935); Flt. Lt. H. T. R. Cripps relinquishes his commission on completion of service (November 19).

AUXILIARY AIR FORCE

General Duties Branch

No. 610 (COUNTY OF CHESTER) (BOMBER) SQUADRON.—D. S. Wilson is granted a commission as Pilot Officer (October 24).

No. 611 (WEST LANCASHIRE) (BOMBER) SQUADRON.—R. N. Birley is granted a commission as Pilot Officer (November 1).

Accountant Branch

No. 609 (WEST RIDING) (BOMBER) SQUADRON.—G. G. Robinson is granted a commission as Pilot Officer (October 26).

ROYAL AIR FORCE INTELLIGENCE

Appointments.—The following appointments in the Royal Air Force are notified:—

General Duties Branch

Group Captains.—A. S. Morris, O.B.E., to Aircraft Depot, Hinaidi, Iraq; to command, vice Group Capt. H. J. F. Hunter, M.C., 11.11.36. C. O. F. Modin, D.S.C., to Headquarters, R.A.F., Iraq, Hinaidi, 18.11.36; for duty as Senior Equipment Staff Officer, vice Group Capt. R. G. Parry, D.S.O., 18.11.36.

Wing Commander.—A. S. Ellerton, O.B.E., to Headquarters, R.A.F., Iraq, Hinaidi, for duty as Senior Personnel Staff Officer, vice Wing Commander W. A. C. Morgan, M.C., 7.11.36.

Squadron Leaders.—A. J. Rankin, A.F.C., to No. 30 (Bomber) Squadron, Dhibban, Iraq; to command, vice Wing Cdr. A. L. Fiddament, D.F.C., 12.11.36. R. L. McK. Barbour, D.F.C., A.F.C., to Headquarters, R.A.F., Mediterranean, Malta; for Engineer duties, 10.12.36. H. M. Whittle, to Headquarters, R.A.F., Iraq, Hinaidi; for Administrative duties, 26.11.36. W. L. Payne, to No. 57 (Bomber) Squadron, Upper Heyford; to command, 14.12.36. R. E. Bain, to No. 43 (Fighter) Squadron, Tangmere; to command, 10.12.36. P. Slocombe, to No. 209 (Flying Boat) Squadron, Felixstowe; for flying duties, vice Sqn. Ldr. A. W. Bates, 11.12.36.

Flight Lieutenants.—H. J. Paine, to Aircraft Depot, Hinaidi, Iraq, 26.11.36. W. J. H. Lindley, to Aircraft Park, Lahore, India, 14.11.36. H. J. Pringle, to Central Flying School, Upavon, 15.12.36. H. L. Dawson, to Home Aircraft Depot, Henlow, 7.12.36.

Flying Officer.—R. G. Yaxley, M.C., to R.A.F. Station, Ramleh, Palestine, 28.11.36.

Pilot Officers.—F. W. Richmond, K. J. Rampling, J. F. Walker, to No. 47 (Bomber) Squadron, Khartoum, 28.11.36. J. H. Slater, to Headquarters, R.A.F., Iraq, Hinaidi, 12.11.36.

Acting Pilot Officers.—The undermentioned are posted to R.A.F. Depot, Uxbridge, on appointment to short service commissions, on probation, 3.12.36:—P. Burnett, J. H. Chappell, M. A. Goodwin, R. G. Le Dieu, F. V. Morello, P. A. Nicholas, B. Platt, S. A. F. Robertson, R. L. C. Todd, H. St. G. Turner, and J. L. Waters.

Accountant Branch

Wing Commander.—W. G. W. Prall, to Headquarters, R.A.F., Iraq, Hinaidi; for duty as Command Accountant, vice Wing Cdr. H. G. Jones, 19.11.36.

Flight Lieutenant.—H. R. Withers, to R.A.F. Station, Cardington, 15.12.36.

Medical Branch

Wing Commander.—D. G. Boddie, to Directorate Medical Services, Air Ministry; for Staff duties, 15.12.36.

Flight Lieutenant.—O. S. M. Williams, to R.A.F. Station, Cardington, 16.12.36.

The AIRCRAFT ENGINEER

"FLIGHT" ENGINEERING SECTION

No. 131 (Volume XIII No. 5) 11th Year December 31, 1936

IMPROVED LATERAL CONTROL

By PHIROZE P. NAZIR, M.Inst.B.E., A.F.R.Ac.S.

MR. P. P. NAZIR has been carrying out aerodynamic research at the Queen Mary College under Dr. N. A. V. Piercy, with support from the Government of India. His original paper on the stalling of tapered wings, published in *The Aircraft Engineer* of November 28, 1935, was the first to call attention to the tip-stalling tendencies of wings with plan form of pronounced taper.

This week we are pleased to be able to publish the first part of an article, written exclusively for us, which describes some of the results obtained by Mr. Nazir during his research on the new type of lateral control which he has invented and patented.

The results are sufficiently startling to merit the very closest investigation, the more so as Mr. Nazir appears to have evolved a very simple method of sucking away the boundary layer. Apart from its use as a lateral control, the Nazir cut slot and trail flap combination would appear to offer possibilities as a high-lift device.

Much work still remains to be done. For example, one would like to know the drag of the cut slot-trail flap combination. Full-scale work is also needed to confirm the results obtained in the wind tunnel at the Queen Mary College. In the meantime, the fact that the Nazir invention allows lift to be maintained up to very large angles of incidence—45 deg. or more—seems to indicate a control of the air-flow above the wing different from, and more powerful than, any tried hitherto.

An illustration showing the air flow will be found on page 42.

The Author.

THE problems of lateral control during landing are becoming of vital importance with the increasing speed of aircraft to-day. Almost every aircraft manufacturing country in the world is carrying out research experiments of some sort to improve the controllability of machines, particularly at low speeds, with some interesting results. Devices must be as simple as possible and practical constructionally, as well as efficient aerodynamically.

With modern high wing loading it is important to decrease the stalling speed while retaining controllability. This has been achieved by the well-known front slot; but unfortunately the benefit occurs at large incidences only. On the other hand, benefits from ordinary flaps occur at smaller incidences but they stall badly and are not in themselves suitable for lateral control. The high speeds of to-day would scarcely be possible without them.

Therefore, I undertook a research with the financial assistance of the Government of India to develop a type of flap which could be used with safety and efficiency for lateral control, both at small and large incidences. It was soon found out that a "cut slot" had to be used in conjunction with the flap. Various other modifications were shown to be necessary during the course of my work. My investigations have been directed towards finding the most efficient combinations.

Wind tunnel development of the device was undertaken at the Aeronautical Laboratory of Queen Mary College. Tests were carried out on both rectangular and tapered wings, in a 4-ft. wind tunnel, at a wind speed of 44 ft. per second. Laminated mahogany models of 30 in. span were used in both cases. Control area occupied 53 per cent. of the semi-span in each case, as will be seen in Fig. 1. The rectangular wing is of "Clark Y" section and the

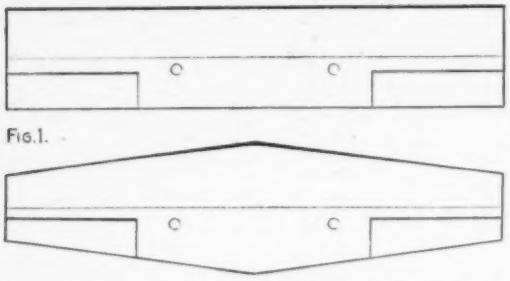


FIG. 1.

Fig. 1. Plan form of rectangular wing, of Clark Y section and tapered wing of Clark YH section.

tapered wing of "Clark YH" section (2 : 1 constant straight taper). Slots were cut through the wing, one at each tip, and flaps of various sizes were tested, with and without the combination of the "cut slots." The size of the normal slotted, Frise and ordinary ailerons as tested was determined by length behind the hinge point, being 30 per cent. of the wing chord. But in my system this aileron is not movable, the flap being used as aileron.

The Rolling Moment

Rolling moment control is contributed to in two ways :—

(1) By increasing lift for the up-going wing, either by altering the camber or by giving a flap or slot effect.

(2) By destroying lift and increasing drag for the down-going wing, either by obstructing the flow over the upper surface of the wing, or by reversing the camber.

It may be advisable to obtain rolling moments equally from increase of lift on the one side and decrease on the other. But the early breakdown of lateral control appears to be due to the quick spread of burbling disturbance upon the rear part of the wing (i.e., the trailing portion) which consequently puts the *lift* aileron out of action. This effect is pronounced upon the tapered wings as described later. It is therefore important to keep the lift aileron from stalling. There is a possibility of controlling the air flow near the leading edge of wings, both for lift and drag effect, in conjunction with ailerons, by the use of slot and saddle combinations.*

The Rectangular Wing

The following types of flaps were tested for rolling moment comparison :—

(1) Ordinary flaps.
(2) Slotted flaps
(3) Frise flaps.
(4) Nazir flaps.
  (*a*) Sliding type.
  (*b*) Arch type.
  (*c*) Trail type

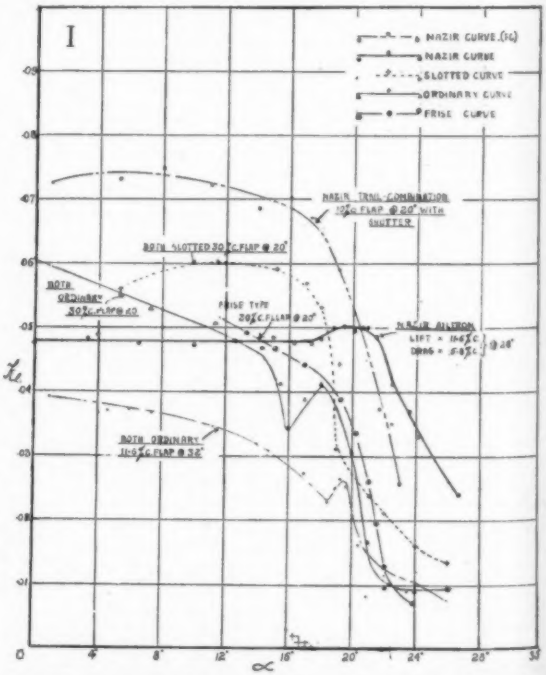
Graph No. I shows rolling moment coefficients of different types of flaps tested as ailerons, on the same wing under identical conditions. It will be seen that the rolling moment of both ailerons (30 per cent. wing chord), ordinary flap ± 20° incidence, indicates a continuous drop from the very beginning, and soon after 14° there is a drop in rolling moment indicating the stall of the wing. My aileron curve appears to be of unusual shape, being constant from 0° to 18° and then rising upwards up to about 21°. The drop in rolling moment after 21° is of the normal type curve. The ordinary type of slotted flap aileron curve as tested (30 per cent. wing chord at ± 20° incidence), indicates a rise from 0° to about 16°, after which the rolling moment falls off rather steeply. The curve for the Frise type aileron which I have tested (30 per cent W.C. at ± 20°) indicates a continuous drop in rolling moment from the very beginning, although it favourably intersects the slotted curve at 19°. This appears to be due to the modification on the drag aileron at large incidences. The constant rolling moment in the case of my aileron is, perhaps, due to the full slot effect at smaller angles of incidence, where, if the slot is sealed with the flap in the identical position, the curve would show a gradual decrease in the rolling moment from 0° incidence. The trail combination curve of a 10 per cent. W.C., with the slot shutter, shows the highest rolling moment of all arrangements. It is approximately double that of the ordinary flap at the stall (± 16°).

It was thought that the effect of both the ordinary equal-area flaps would be interesting for the purpose of comparison. Therefore an ordinary flap of 11 per cent. W.C. was tested for rolling moment under identical conditions. The result is given in the same graph. It will be seen that both my rolling moments are twice as great as those of the ordinary flap at a main-wing incidence of about 20° ; and about four times as great at 22° incidence.

Some remarkable air flow observations were made, which are described later. Studying the air flow by special streamers helps considerably to modify the work in the wind tunnel and saves time and labour.

Lift Aileron More Powerful Than Drag Aileron at Large Incidences

Although a satisfactory rolling moment was obtained from both ailerons, it was necessary, from the lift point of view, to find out which aileron gave greater control of the two. Special tests were therefore undertaken without the drag aileron in position, to find out how far the lift-side flap was effective. Several tests indicated that the lift aileron was the more powerful, particularly at large incidences. A great number of experiments were carried out to bring the lift aileron to perfection. The effect of a single lift aileron is compared with that of both ailerons. The rolling moment curve of both ailerons indicates an unusual increase in efficiency at large incidences. The maximum K_l = (rolling moment coefficient) occurs at 21° incidence, delaying the stall from about 16° to 22° (an important new feature).

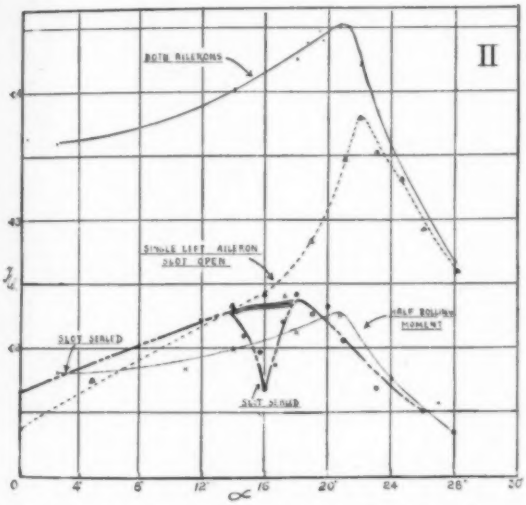


Rolling moment due to ailerons. Comparison of Nazir type with normal, slotted and Frise ailerons. Clark Y section rectangular wing 30in. by 6in. ; 44 ft./sec. ; R = 133,000.

* See Patent No. 323074/32.

Taking now the single lift aileron curve, which is dotted in the graph, it will be seen that about 78 per cent. of the full rolling moment is obtained at 21° incidence. The single lift aileron is more powerful than the drag aileron from 8° onwards and about 50 per cent. more than the half rolling moment even at 28°. The angle of maximum rolling moment is 22° for single lift aileron, compared with 21° for both ailerons. Of all the arrangements tested the trail flap appears to give the widest safe speed range.

It was thought that the effect of a slot would be interesting, and therefore some further tests were carried out with the cut slot in sealed and open positions, and with the flap in the identical position on the lift-side aileron only. The drag flap was removed in both cases. The result is given in the Graph II, which shows the effect of the cut slot through the wing. It will be seen that although the



Effect of single lift aileron compared with full rolling moment of both ailerons. V = 44ft./sec. ; R = 133,000

"slot-open" rolling moment curve (dotted) at small incidences is slightly below that of the "slot-sealed" rolling moment curve it increases considerably from 13° onwards up to 28°. The "slot-sealed" rolling moment, on the other hand, indicates a steep stall at 16°, after which there is a recovery in the rolling moment, but a second drop occurs at 18° in the normal manner. *After the stall, the lift is approximately doubled by opening the slot.* The increase in stalling angle is also affected by the opening of the slot, from 16° to 23° ; this should give a considerable margin of control in case of accidental stall. Several air flow observations indicated severe buffeting taking place, on the upper surface of the wing, from 20° onwards with the slot in the "sealed" position. Opening the slot eliminated this violent turbulence.

The Double Wing Arrangement

Among the many high-lift arrangements the double wing appears to have been in favour on foreign air lines. Although several full-scale experiments have proved quite satisfactory, and the device is important, the fact that *two* wings create greater drag at high speeds than *one* wing should not be forgotten. There is also the slot effect to be considered. The slot between the two wings remains open, even at small incidences ; this may be detrimental at high speeds. Referring to Graph No. II the "slot-sealed" curve indicates a drop in rolling moment at 16° at the stall, at a Reynolds No. of 133,000. When the cut slot in the wing is sealed in my experiments, the device resembles the double wing arrangement, except for the fact that in my experiments

FIG. 2.

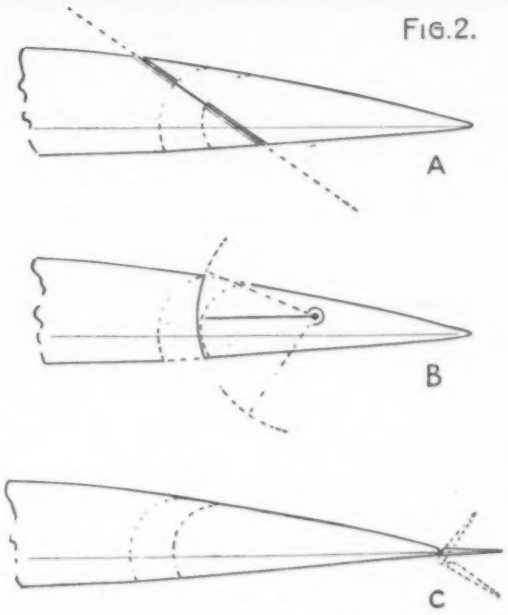
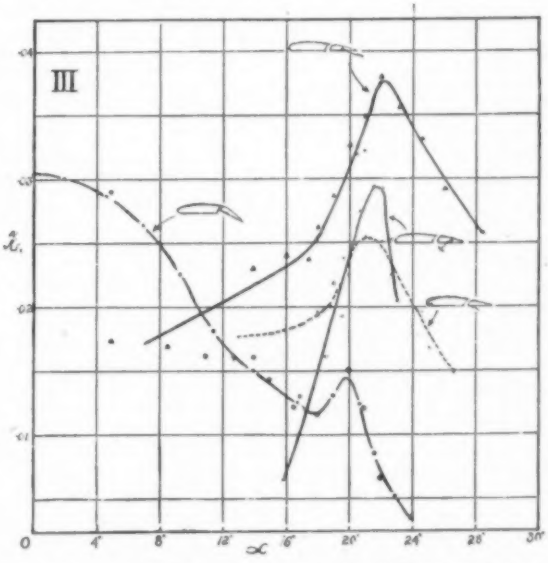


Fig. 2. Three arrangements of the cut slot and flap combination, A, the sliding, B, the arch type and C, the trail type.

the smaller wing is in the form of a flat plate instead of an aerofoil, and very small

According to some higher Reynolds' number tests, the double wing device appears to flatten out the curve at the stall, continuing the lift curve as indicated in the graph. The cut slot in my experiments, with the same arrangement, seems to *double the lift of the wing after the stall, and also increases the stalling angle of the wing from 18° to 22°.*

Another advantage of my arrangement would be that the trail flap of my device would smoothly nest behind the wing without having a gap or slot between it and the wing, which should eliminate the extra drag that may be set up by two wings at high speeds. It is possible that high-speed tests may still further improve my results.



Lift effect of single aileron alone. Rolling moment due to lift aileron of various combinations.

Single Lift Ailerons of Various Designs

A great number of slot-and-flap combinations were tested, three of which are shown in Fig. 2.

(*a*) is a sliding-flap arrangement, intersecting and closing the cut slot when required.

(*b*) is an arch-flap device moving up and down on a radius arm and also modifying the flow through the slot when required.

(*c*) is the trail-flap arrangement behind the trailing edge of the wing, working in conjunction with the cut slot, which appears to be the most successful of all arrangements.

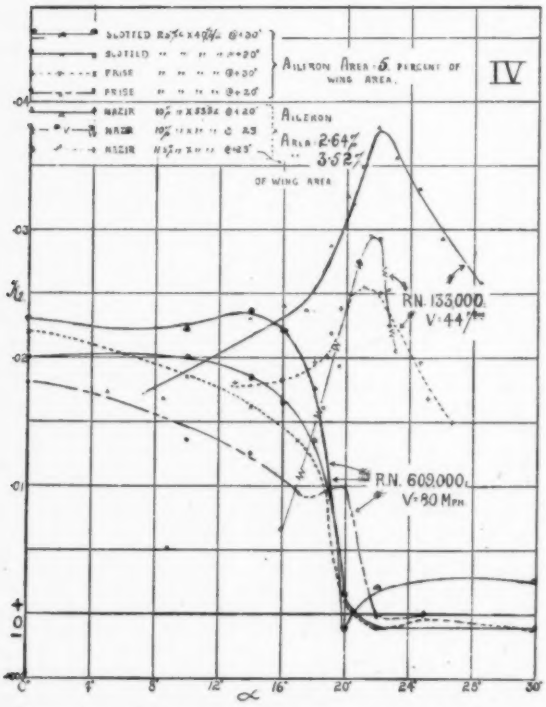
Graph No. III shows effects of three different types of combinations (single lift ailerons together with the ordinary flap). It shows that although the rolling moment of the 30 per cent. W.C. ordinary aileron is higher than any of the above at small angles it rapidly drops below all of them as incidence increases. The sliding-flap aileron (lift = 11.6 per cent. W.C., drag = 5.6 per cent. W.C.), although about one-third the aileron area of the ordinary flap, more than trebles the rolling moment at 21°.

The arch-flap arrangement shows slightly greater increase between 20° and 22° only; it otherwise drops below the sliding-flap arrangement, owing to an early slot effect coming into action with the downward movement of the flap. The trail-flap aileron (10 per cent. W.C.) shows the highest single lift rolling moment, from 11° onwards, and the maximum K_l occurs at an angle of 22°; even after this the lift appears to be much higher than any other arrangement.

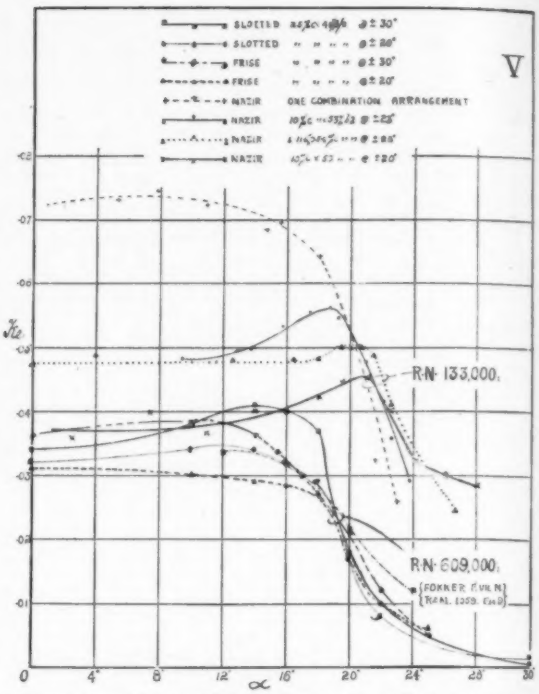
The improvement of my device in regard to rolling moment is probably due to the fact that I find it possible to make the lift aileron even more powerful than the drag aileron at large incidences.

Factors of Increasing Lift

To obtain high lift on fixed wings of aeroplanes the following factors come into action, either singly or together,



Comparison of Nazir single lift ailerons with slotted and Frise types. (N.A.C.A. T.R. No. 422, tables II and VIII).



Comparison of both Nazir ailerons with slotted and Frise types. (N.A.C.A., T.R. No. 422, tables II and VIII).

depending upon the angle at which the greater lift is required.

(1) The flap effect, for normal incidences.

(2) The slot effect, for large incidences.

(3) The broken camber effect, at large incidences.

The third factor takes place either when a rear part of the main wing itself, or a flap, is moved downward; this alters the original profile of the wing. The flap then tends to move away from the flow path of the smooth air stream, resulting in some loss of lift over its upper surface. This effect of a broken wing profile appears to limit increase of lift and stalling incidence. In my experiments the unbroken wing profile contributes to high lift combined with delayed stall.

So far as can be judged from the high-lift devices in use to-day, only one or two of the above factors are combined together, namely, the slot and flap effect, which no doubt gives a satisfactory result, but probably not an optimum. My experiments suggest that unbroken top profile of the upper surface opens out the possibility of sucking away the boundary layer from the rear of the wing, which is described later. All my visual observation tests substantiate extra efficiency gained by the *three combined factors together*, consequent upon the cut slot and flap.

Comparison With Other Lateral Control Devices

There are considerable data from wind tunnel results of various lateral control devices in the N.A.C.A. reports with which my results compare favourably, even with smaller control surfaces. The area of my ailerons is 2.64 per cent. and 3.52 per cent. of the wing area, compared with 5 per cent. of the N.A.C.A. results. Graph No. IV shows a comparison of my arrangements (on a "Clark Y" section at a velocity 44 ft./sec. and R = 133,000) with the results published in the N.A.C.A. Technical Report No. 422 (in Table Nos. II and VIII).* Slotted and Frise type ailerons have been compared for rolling moments of single lift ailerons, with three arrangements of my device.

* Tests on Clark Y wings at a speed of 80 ft/sec. R = 609000.

Although the best slotted curve appears to rise at about 12° incidence, it falls off again at 16°, dropping so rapidly as to even reverse at 20° incidence. The other slotted curve of ± 20° flap deflection indicates less rolling moment from 0° to about 19° incidence, after which there is a slightly greater rolling moment up to 20½°. The Frise type curve of ± 30° flap deflection does not show the effect of the slot but indicates a gradual drop in rolling moment, up to about 17°, after which there is a rapid fall of efficiency. The ± 20° Frise curve indicates an increase of rolling moment, from 19° onwards, although at small angles the lift is less. The increase of 20° is even greater than the best slotted curve shown. However, all the N.A.C.A. curves indicate a drop in efficiency, falling rapidly after 16°. It will now be seen that all my curves, contrary to other results, rise considerably at large incidences. Taking the trail flap arrangement (of 2.64 per cent. aileron area) the curve indicates an unusual increase in rolling moment (lift) from the very beginning, up to 16°, after which there is even a still further upward peak up to 22° incidence.

The angle of maximum rolling moment is increased from about 14° to 22° incidence, after which the curve indicates a drop in the normal manner. The arch-flap curve shows a rapid increase, even from 16° up to about 21°, after which it falls off rather steeply. The sliding-type curve (shown dotted in the graph) rises from 12° onwards up to about 21° and falls off in a similar manner.

Full rolling moments of both ailerons have also been compared with results published in the same report. These are given in Graph No. V. The best slotted curve suggests a gradual increase in rolling moment up to about 14° incidence, after which it drops in the normal manner, and at 22° there is about 22 per cent. of the maximum rolling moment; an advantage due to the drag aileron. It will be seen that although the single lift slotted aileron shows a negative effect of the control at 22°, in Graph IV the drag aileron appears to give greater rolling moment of the two, after the stall. The shape of the N.A.C.A. curves after the stall (i.e., at about 16°) indicates a similar amount of drop in rolling moment. The Frise type curve shows the effect of the more powerful drag aileron from about 19° to 24°; giving a little extra rolling moment from the drag aileron only.

A result of lateral control tests on a Fokker F.VII Monoplane (from R. & M. 1059, Fig. 9) is also plotted for comparison. The Fokker curve indicates a greater rolling moment at large incidences than any of the N.A.C.A. results, but is much below my curves. Comparing now the three Nazir arrangements with the slotted and Frise types for full rolling moment of both ailerons, it will be seen that the rolling moment is more than double at 20° incidence. The trail flap stalls at 22°, other devices showing slightly earlier stalling. The increased effect due to the combination is, however, seen in all arrangements at large angles. (See picture on p. 42.—Ed.).

(*To be continued next month.*)

AN ENGINEER at the PARIS SHOW

By H. J. POLLARD, Wh.Ex., F.R.Ae.S.

(*Continued from p. 32, Nov. 26, 1936*)

PASSING from the Potez on to the adjacent stand of the Marcel Bloch Company, one gathered the impression that the aircraft there exhibited—the 131 Bomber—was the best finished in the Show. In this, as in most of the other interesting cases, an internal examination was not possible, but it was ascertained that the machine was devoid of equipment of any description; was, in fact, completely empty, probably being without engines. In place of bomb doors a well-fitting panel had been screwed in place. It is not safe, therefore, to judge "finish" from casual observation alone, for when an aircraft, particularly a prototype, has been hand-made and modified to suit all requirements, and when all parts work that should work, its appearance will most likely be markedly different from that of the machine in series, i.e., when all details are finally determined and tooling is completed. In any case, the appearance of the prototype ready for flight, as well as that of the same type of aircraft in series production, will not be the same as that of an aircraft prepared for show purposes only. I am sure these facts are lost sight of by many visitors to the Show, who commented freely on the wonderful French finish. Apart from finish, however, the Bloch 131 had a generally workmanlike appearance.

One feature that calls for criticism was the use of an adjustable tailplane, together with what appeared to be trimming strips on the elevators—controllable from the cockpit. Experience has shown that the use of such strips eliminates the need for adjusting the complete tail. Probably the strips were of the "follow-up" type only, but in any case an adjustable tail is generally considered to be a back number device. Trimming strips give the desired results in a lighter and more effective manner. The monocoque body makes the best possible anchorage for a metal-covered tail, simple corner angles being all that is necessary for the connection.

All the movable surfaces on this aircraft were metal-covered, but the number of metal-covered monoplanes in the Show having control surfaces so covered were in a minority. Very little information could be obtained on the use of Magnesium alloy sheets, but undoubtedly good use of that material can be made for the purpose with no increase in weight of the finished unit, providing the internal structure of the elevators, etc., has been intelligently designed.

The only other feature in which the Bloch 131 differed from the other exhibits was in the use of a forward-folding undercarriage, and considering how far forward most of the power units were placed ahead of the wing leading edge the almost universal adoption of the rearwardly folding undercarriage was rather surprising.

One wonders why French designers push their power units so far forward if the undercarriage question is not the reason; possibly to keep the pilot well outside the plane of the airscrews. The problem of adequate cooling may furnish the answer, but, generally, if the centre line of the engines is about one-half of the cowl diameter ahead of the leading edge of the wing, cooling conditions are about as good as can be obtained, and no advantage is likely to accrue from advancing the engines farther ahead than that. These long overhung engine mountings certainly add appreciably to the weight, and one wonders wherein exactly the compensation lies if the undercarriage is not to be folded forward.

Remarks on the super excellence of the windscreens were made in the first part of this article, and similar comments must be made in regard to engine and other cowls. The French designers and mechanics have a flair for neatness in these matters, *i.e.*, ingeniously hidden fasteners and the like. It is impossible to say how these things function in service, but the effect is certainly "there" on the stand.

By way of concluding the impressions of complete aircraft with a comment on the civil side of the Exhibition, if one were buying an aircraft for one's own use, the Praga 210 would be well in the running for the purchase,

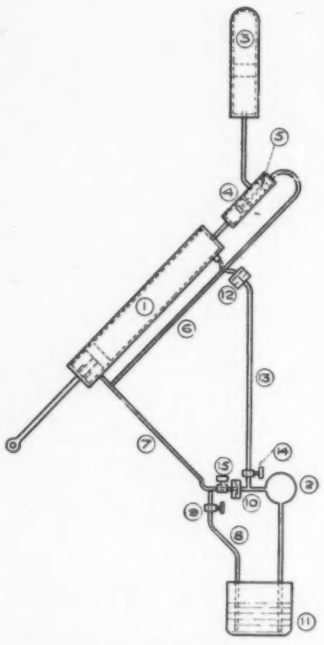


Fig. 1. Diagrammatic view showing Messier method of undercarriage retraction.

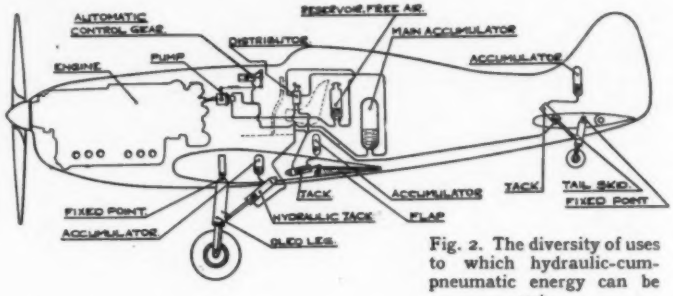


Fig. 2. The diversity of uses to which hydraulic-cum-pneumatic energy can be put.

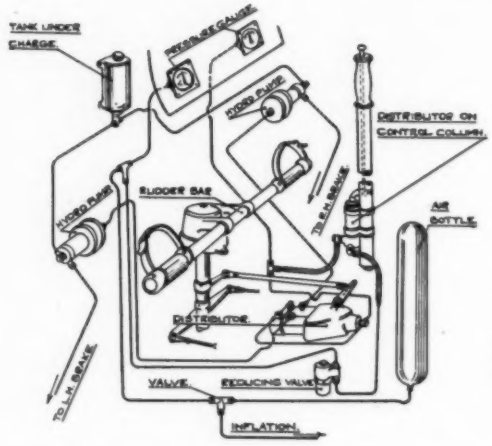


Fig. 3. Differential braking obtained by hydro-pneumatic control.

particularly if one is inclined to run to weight, and also if one usually travels with a lot of heavy luggage, which in this case could be stowed in the nose of the aircraft. Then such a machine, with engines rear of the rear spar, might have the necessary centre-of-gravity balance. Certainly this positioning of engines is ideal from the view and noise aspects.

It remains to make a brief study of the exhibits shown in the galleries. We have already commented on the excellence of spot welding as demonstrated by the Sciaky Company, and we will now pass on to the other exhibit that aroused as much interest as anything in the Show, namely, the numerous devices on view on the Messier stand. Before describing these devices, the following may be said as a generality.

As aircraft grow in size and power they become more complicated, and actuation of the many auxiliary motions must be made possible by a single individual in a simple manner. These auxiliary motions are, for example, operation of the automatic pilot, the motor starter, the raising and lowering of the undercarriage, the control of the flaps and slots, control of sliding roofs, wheel brakes, variable pitch airscrews, etc. Then there are military requirements such as bomb-operating devices, armament and gun turrets, all of which must be made to function in a simple way and with the minimum of effort. Mechanical systems of rods and gears are scarcely suitable for use on such a non-rigid structure as an aeroplane, while there are definite limitations to what can be done with a Bowden cable and analogous means of transmitting motion. Again, electrical controls are more attractive in theory than practice; they involve heavy accumulators, switches, and similar items.

The best way of obtaining the necessary control is by servo motors with compressed air and hydraulic means combined. There is nothing new in the method, of course, which is simply the hydraulic lever invented by Pascall, and this is definitely better than levers, wires and gears in the above applications. It consists of enclosing the necessary quantity of pneumatic energy in a bottle and then releasing it independently of the action of the servo motor or the pilot's own energy. The operation of valves is enough to induce the necessary motion in the component concerned. These valves must be grouped on a distribution board in a position convenient to the hand of the pilot so that he can operate any one of the auxiliary pieces of apparatus through the respective valve.

Operation

The principle of the control of the undercarriage created by Messier satisfies the following aims:—

(1) It assures the automatic descent of the undercarriage independently of the energy of the plane's motor and of the muscular force of the pilot.

(2) In the case where the accumulated source of energy in use should fail, as the result of an accident, it supplies a second means of landing independent of the first. The schematic installation of this apparatus is shown in Fig. 1. It is composed primarily of a double-effect jack (1) joined in the first place to a pump (2) and on the other hand to a hydraulic accumulator (3). The liquid which passes from the jack to the hydraulic accumulator passes through a nozzle (4) whose aperture is controlled by a small piston (5). One surface of this piston is connected by means of a tube (6) with the tubing (7) which joins the pump to the jack. A branch (8) allows by the turning-on of the taps (9) the liquid to escape; that is to say, the liquid which has been expelled by the pump into the jack.

To retract the undercarriage, the pilot sets the pump (2)

in action which causes the displacement of the piston and jack; thus he obtains simultaneously the retraction of the undercarriage and, by the increase of pressure in the accumulator (3), the putting into force the reserve of the necessary energy to cause the automatic descent of the carriage without bringing into play any extraneous force. The carriage is thus retracted by the tap (9) which is turned off since the pump (2) is furnished with an anti-ricochetting plug, which prevents the liquid escaping through the pump.

When the pilot wishes to operate the descent of the carriage, it is sufficient to turn on the tap. Under the effect of the pressure of the accumulator, the piston of the jack is displaced by diverting the liquid towards the reservoir (11) through the intermediary of the tap (9).

When the jack comes to the end of the circuit, the plug (4) is opened by the action of a spring and brings about the automatic jacking of the carriage. It should be noted that if, for one reason or another, the action should be stopped in the course of operation, the plug will bring about the jacking in any position of the carriage.

Safety Device

It is necessary to ensure the descent of the landing apparatus even if the accumulator (3) and the tube which is joined to the jack should be in process of deterioration. For this purpose a second feeder for the jack (12) exists, a feeder which is provided with an anti-ricochetting plug and which is joined to the feeder for the pump by means of a tube (13). All that is necessary, therefore, in the case of a breakdown, is to turn on the tap (14) and the tap (9) after having turned off the tap (15). Thus one is enabled to procure, through the functioning of the pump (2), a complete descent of the undercarriage for landing independently of the system normally employed. It should be pointed out that the device explained above is purely systematic, since the operation of these different taps is brought about by means of a single organ which does not require any complicated operation on the part of the pilot. These devices are actually used for practically all the general run of French aeroplanes provided with undercarriages capable of retraction.

The large diversity of services and method of installation are shown diagrammatically in Fig. 2, while the installation of the braking system is shown in Fig. 3. These diagrams are self-explanatory. All these things and others, including the operation (by the same method) of a hook for landing, were shown on a mock-up skeleton fuselage and wings on the Messier stand, and this undoubtedly was the most instructive exhibit in the Show.

Another extremely interesting exhibit was a part of the aerodynamic section shown under the auspices of the Ministère de l'Air. The section was that in which the "Stroborama" (L. & A. Sequin patents) was working in conjunction with a propeller rotating at high speed. Vortices were formed at the top of the rotating blade and trailed off down wind as indicated in Fig. 4, the blade being rendered visually stationary by means of the "Stroborama." The educational and practical value of this device should be immense.

Fig. 4. Example of photograph taken with "Stroborama" cinematograph camera.

Arrested Motion

By this means it becomes possible to discover the true phenomena taking place during the motion of the object to be investigated (vibrations, bouncing, distortion, etc.). In every case the most accurate measurements can be taken, since the object is seen in an apparently static position at any particular instant of its travel. These observations can only be carried out in a useful manner if the pictures have a sharp outline and are absolutely steady at high velocity; the lighting must also be very powerful to ensure normal working conditions in broad daylight.

The "Stroborama" fulfils this double purpose; its application for the measurements of vibrations and distortion of fast-moving organs of machinery is almost universal, and will no doubt be of general application in industry for investigations of cam profiles, valve bouncing, valve spring vibrations, torque and bending of crankshafts and connecting rods, investigation of lubrication, carburation, vibrations of crank cases and moving parts, and research in the injection process of heavy fuel motors.

The most abundant exhibits in the galleries were light alloy forgings and castings, which have always been well in evidence at these Exhibitions but never so much as on this occasion. While their use is certainly growing in this country, we are a long way behind French constructors in this respect. Perhaps current regulations have something to do with this, although one does not question their necessity. It is thought necessary here to examine radiologically certain light alloy castings used for various purposes, while on the Continent, at any rate in some countries, breaking tests on parts picked out at random are considered an adequate safeguard. There is no means of knowing whether that is so or not, but radiological examination adds greatly to the cost of parts, and may also cause inconvenient delays.

Light Alloys

The quality of Continental light alloys appears to be well up to our own; for example, a material known as Durulium, marketed by Trefileries et Laminoirs de Havre, having an average ultimate strength of about 30 tons per sq. in. and a yield strength of over 25 tons per sq. in.

It is impossible, of course, to give particulars of everything on view, but other "high spots" which appealed to me were a portable Oleo-Pneumatic Riveter shown by H. Jambon, 23, Rue de Marvois, Paris, 16. Notice was also taken of Commandes Oleo-Pneumatiques Olaer. In the undercarriage-retracting device on that stand, a hydraulic cylinder was secured to the middle of the folding radius rod in the manner shown diagrammatically in Fig. 5. It is evident that considerable offset loads have to be allowed for in the design of the adjacent structure for the folding away of the mechanism, while the operating pressure was certainly rather higher than that to which we have become accustomed for this particular purpose.

Mr. Dowty showed some of his interesting mechanisms, which are too well known to need reviewing here, while the Chobert riveting machine (marketed by Aviation Developments, Ltd., Argyle House, 27-31, Euston Road, London, N.W.1) attracted a good deal of attention. The scheme has been well known in this country for some years, but Chobert, with his magazine-fed gun, appears to have developed the method further. The total elimination of "blind riveting" (*i.e.*, securing of sheet metal together by riveting from one side only) from aircraft construction is almost impossible, and the Chobert method of overcoming the difficulty is recommended.

What appeared to be a really useful control for carburetter and other operation was shown on the stand of

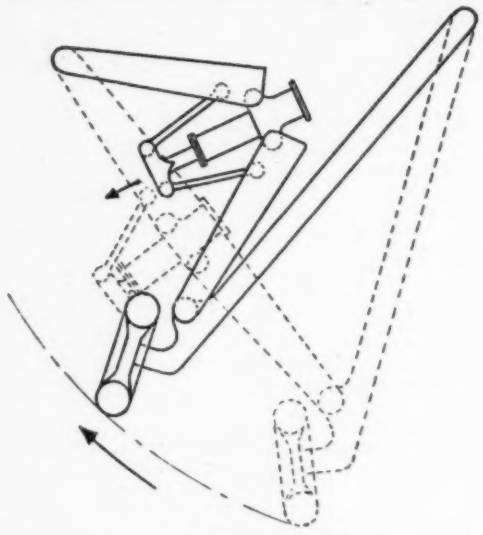
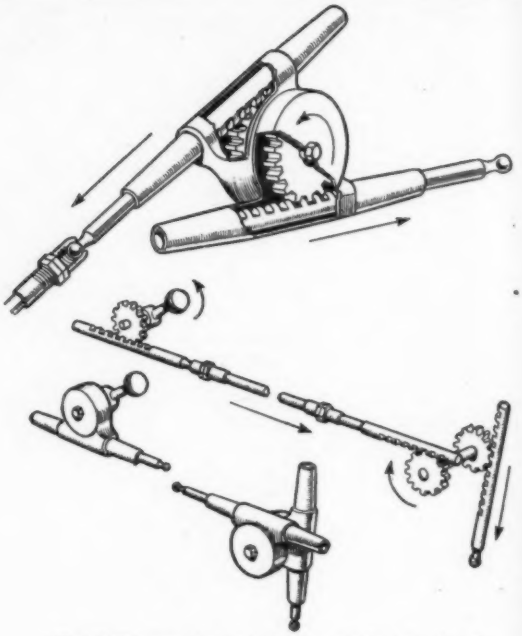


Diagram of Olaer retracting principle.



The Rollet remote control has no "lost motion"

the Rollet Company, and is illustrated in Fig. 6. The mechanism can be made continuous or reversible in directional movement, and the motion can be transmitted round corners with the facility of that obtained with the flexible type of drive. Moreover, there is no "lost motion" in this case; by the simple loosening and retightening of a nut, adjacent rods can be fixed at any desired angle. The sketch is self-explanatory.

In conclusion, the questions asked by everyone were: what are the outstanding impressions of the Fifteenth Aero Exhibition and how do British machines compare with those exhibited? Such impressions are easily defined. The main hall was comfortably filled with well-polished, elegantly mounted aircraft, most of which were a delight to the eye, but which were completely inaccessible to the technically minded. As to aerodynamics, if, on the one hand, it appears that we have little to teach Continental exhibitors, on the other hand there is little they can teach us. As to construction, if we are satisfied that our internal structures are adequate (and in view of the fact that as regards operational requirements it would appear that we are in no important respect behind the others), then we may feel reasonably satisfied with the position.

There were too many vacant spaces in the galleries, but such space as was occupied was well utilised; the chief value of the Show to the aircraft engineer was in the exhibits off the main floor. The Exhibition was the most distinctive yet held and generally the most useless, as, apart from small civil types of aircraft, engines, instruments, etc., there was too much secrecy about details, and it is very doubtful whether such exhibitions in the long run can possibly justify the cost involved.

SUMMARIES OF A.R.C. REPORTS

REPORTS published by His Majesty's Stationery Office, London, which may be purchased directly from H.M. Stationery Office at the following addresses: Adastral House, Kingsway, W.C.2; 120, George Street, Edinburgh; York Street, Manchester, 1; St. Andrew's Crescent, Cardiff; 15, Donegall Square West, Belfast; or through booksellers.

THE VARIATION OF EXHAUST GAS TEMPERATURE ALONG THE TAIL PIPE OF A MOTH AIRCRAFT, AND THE EFFECT OF A SIMPLE SILENCER. By A. W. Morley, M.Sc. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1705. (9 pages and 15 diagrams.) August 15, 1935. Price 2s. net.

An investigation was required of the variation of the exhaust gas temperature in a long tail pipe with and without a silencer. For this purpose experiments were made on a Moth, which was fitted in turn with :—

(*a*) A standard tail pipe about 11ft. long leading along the port side of the fuselage with an expansion chamber about 6ft. from the open end of the tail pipe. (In the standard Moth this expansion chamber is an empty cylindrical vessel, but in the Moth used the chamber contained an obsolete type of baffle.)

(*b*) A plain pipe of the same length and diameter, but with no expansion chamber.

(*c*) A Burgess silencer fitted in place of the expansion chamber in (*a*) above.

Gas temperatures were measured with thermocouples, arranged at six points approximately two feet apart along the tail pipe, one thermocouple being arranged to measure gas temperature near the centre of the silencer.

Tests covered conditions of level flight, full throttle climb, and glide. To discover if any combustion occurred, glides were made :—

(1) In the normal manner, with the fuel supply on, throttle shut, switches on.
(2) With the supply of fuel shut off, throttle shut and switches on.
(3) With the engine switched off, throttle shut and fuel on.
(4) With the engine switched off, throttle open and fuel on.

The maximum exhaust gas temperature with any of the exhaust systems tried on this aircraft under full throttle conditions of level flight or climb is 890° C. at 1-1/3 ft. from the engine and decreases 27° C. per foot run along a plain tail pipe.

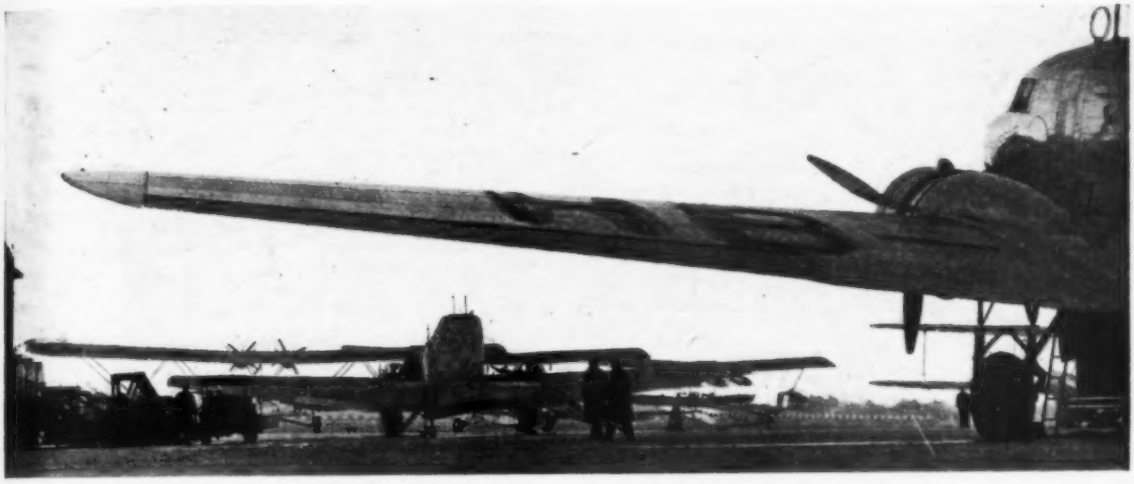
It is shown by gliding tests that burning can occur in the obsolete baffle chamber. Under the same conditions in a Burgess silencer, no burning sufficient to raise the gas temperature took place.

FIG. 4.

The Nazir "cut slot" and trail flap combination at work. This illustration, which really belongs in the next instalment of Mr. Nazir's article, is reproduced here in response to numerous requests which we have had for an explanation of the Nazir device. Note that although the main wing is at an angle of incidence of 45 deg., there is a distinct circulation over the rear portion, so that even at this large angle the lift is considerable.

COMMERCIAL AVIATION

— AIRLINES — AIRPORTS —



CHRISTMAS RUSH : A tarmac impression at Croydon on December 24. Beneath the port wing of the Swissair Douglas can be seen an Air France Wibault, an H.P. 42, *Scylla* and *Syrinx*, while behind the Douglas is a Railway Air Services' D.H.86.

THE WEEK AT CROYDON

Christmas Luck : Urban Paraphernalia : Super Charter : Using the Approach System

A CERTAIN amount of interruption of air services at Christmas time was inevitable as a result of anything but seasonable weather. In the main, however, communication between England and the Continent was stoutly maintained, in spite of the B.B.C. announcement on Boxing Day that there had been no movement at all on the air routes that day.

On Christmas Day itself the luckless Capt. Horsey, who none the less keeps his tail up, spent the day *en route* for and in Paris. Skies were blue and it was indecently warm up over the clouds, but stewards served the traditional fare. The luck of the ballot, plus one Christmas Day in Hospital, by the way, has deprived Capt. Horsey of all Christmas festivities ashore in his own country for the past six years. One unfortunate British pilot found himself heading at great speed towards Budapest, and a number of reluctant foreign pilots found themselves in England. Wiser ones brought their wives with them and tasted the joys of Christmas festivities at one or other of the big London hotels.

Reporters called suddenly back to consciousness after Christmas and told by ruthless editors to put ice on the brow and to create a sensational story to fill the empty columns, fastened on the protest of the Purley and district residents against flying in the vicinity of their houses, and, incidentally, of the airport. Such headlines as "Croydon's Fate" and "Will Croydon Go?" were freely used in Sunday's and Monday's newspapers. Some writers advocate Heston as a permanent alternative. One seems to remember houses round those parts, and, whatever Croydon might offer in the way of sporting obstacles and however remiss the authorities may have been in obtaining powers to restrain building developments within reasonable limits, nobody has yet thought of erecting a gargantuan gas-holder on the verge of our much-maligned airport. Heston is an excellent aerodrome, one of the few, in fact, with the clock so placed that the approach of opening time can be seen from about 500 feet, but it is farther from the Continent than Croydon and it is usually necessary to cross a portion of suburbia to reach it. The purlieus of London vomit smoke and grime which form a fiercer fog than Croydon can boast of.

Nosing around amongst factory chimneys and church spires in an endeavour to descend to one's terminal aerodrome (for descend one *must*, despite meetings held, and resolutions passed by local residents whose main claim to fame seems to be that they have all lived in the vicinity of an airport ever since it existed, without ever finding out the first elementary thing about flying) is poor fun, indeed, as some early experiences at Continental aerodromes, set like jewels in the heart of cities, clearly demonstrated to me. Nothing looks so sharp as a church spire at close quarters, and nothing so unsympathetic as a leering stone gargoyle peering in at the cabin window. To look down a factory chimney is bad, but to be amongst them in visibility which makes that dolorous occupation impossible, is infinitely worse.

Swissair, who, by the way, are taking on more air stewardesses, and who, like K.L.M., have come to the conclusion that for certain types of aeroplanes and certain routes stewardesses are better adapted to the task, have had a most successful Christmas period on the London-Zurich run, the services being duplicated almost daily. No wonder this service is popular with English winter sports enthusiasts, for, leaving Croydon at 9.20 a.m., passengers find themselves in Switzerland well before tea, with time enough to look round, unpack, and get ready for the next day's sport.

On December 24 a special K.L.M. Douglas left Croydon for Karachi with six Indian passengers who arrived at

Commercial Aviation

Croydon in a Rolls-Bentley. They could not obtain accommodation on any of the regular lines, and therefore had to charter a not inexpensive special machine. No doubt the Rolls-Bentley has a wonderful lamp, which, when rubbed briskly with a roc's egg or something, produces the wherewithal plus 100 per cent. Anyway, they left at 8 a.m., and Commander Duimelaar, one of the K.L.M. veterans, expected to get them to their destination in four days.

Everyone at Croydon was delighted to hear of the highly successful England-Egypt-England trip made by *Caledonia*, for the machine was piloted by Capt. Cummings, Capt. Powell and First Officer Garner, all well-known figures amongst Croydon personalia.

Last Monday night was an extremely unpleasant one from the point of view of landing at Croydon. Horizontal visibility was not bad, but vertical visibility was poor and not improved by ground lighting. Several machines not fitted for ultra-short-wave reception landed elsewhere, but two Swissair Douglas machines landed safely by using the Lorenz beam and the marker beacons. This, in fact, was the first occasion on which the installation at Croydon had been used in service—the Swissair pilots have had lots of practice with the system at Zurich. A. VIATOR.

Caledonia Sets the Pace

CARRYING the Christmas mails, the Short long-range Empire boat *Caledonia* last week flew from Alexandria to Marseilles, non-stop, in a little over eleven hours. The Marseilles to Southampton run was covered in about four hours.

African Coaster

THE first of the Sikorsky S.43 amphibians purchased by the Cie. des Chargeurs Réunis for use on a new passenger and air mail service between Dakar (Senegal) and Pointe Noire (French Equatorial Africa) has now arrived at Dakar in charge of French and American pilots.

Air Mails in France

AIR FRANCE is shortly to take part in the reorganised internal air mail system of France. The Chamber of Deputies has voted a postal budget which includes a sum of 10,000,000 fr. to enable air mail letters to be carried without surcharge between Paris, Avignon, Marseilles, and Cannes and between Paris Bordeaux and Toulouse. Letters posted in the morning and in the afternoon for the south-west and the south-east of France will automatically be carried by air. There will be three services daily between Marseilles and Paris.

The machines to be used will be Caudron Simouns, but these will later be replaced by Caudron twin-engined Goelands. Night flying will not start until the aerodromes on these routes are equipped with radio beacons. After the budget has passed the Senate the Air Bleu Company will be liquidated and a new company will be formed in which the State, the former shareholders of Air Bleu and Air France will hold the predominating interest.

Near Eastern Service

THE reopening of the local service from Damascus to Baghdad has been announced by Air France. The service leaves Damascus on Mondays and returns on Tuesdays, the start being made at dawn in both cases. The flight takes about four hours. A regular car service runs between Beyrouth and Damascus in connection with the early morning departure; local car services operate between Damascus and Haifa, Aleppo and Jerusalem.

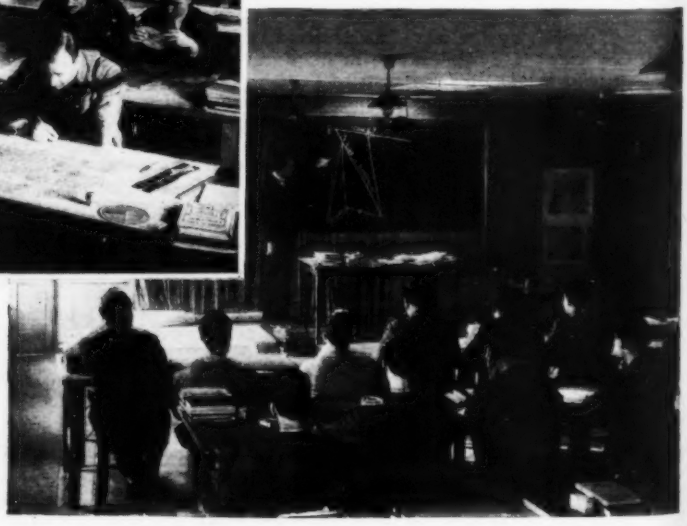
The Durban Base

A TECHNICAL commission is now investigating various sites for the establishment of a base at Durban, South Africa, for the Empire boats. Among the various suggested sites are the Maydon channel at the entrance to the graving dock, the channel near the Island View Oil Sites in the shelter of the bluff and Salisbury Island, and the west side of Salisbury Island near the ferry landing-stage. It is understood that Mr. Pirow, the Minister of Railways, is now to make an inspection himself.

The Monospar Croydon Affair

THE Air Accidents Committee's report on the loss of the Monospar *Croydon* in the Timor Sea states that the pilot and radio operator should have known the D/F instructions in relation to sunrise, sunset, and night effects, and should not have relied on the bearings given them by Darwin.

The crew, says the report, were negligent in not taking action to rectify the 10 deg. compass error on the flight to Australia. The Darwin station, knowing the limitations of the system of direction-finding, should not have given bearings to the Monospar during darkness. The blame, therefore (and in spite of the wording of the report) appears to rest primarily on the shoulders of the personnel at the Darwin station. Why, in the name of the god of night-error, did the station call its bearings "first-class" when they were most certainly not of any class at all?



BACK TO SCHOOL. Classes in progress at the Imperial School of Air Navigation. On the left is a general view of the main classroom with the "boys" at work, while in the other photograph, Mr. C. W. Martin, the principal, is working an "interception" problem on the board; the "indoor" compass base can be seen on the right. During last year no fewer than 105 day students attended the school, and the percentage of passes has been 60 in two examinations.

Dublin's Airport

THE Dublin County Council has approved the scheme for a municipal airport at Collinstown, and has agreed to contribute a reasonable amount of money towards the cost of the project.

New Lisbon Service

A NEW service between Lisbon and Stuttgart, *via* Burgos and Marseilles, has been opened by D.L.H. The service will be operated three times weekly with Ju.52 machines, and has no connection, of course, with the direct service for the South American mail.

Jersey's Airport Officer

LT. COMMDR. C. W. PHILLIPS, who has been Mr. W. Lindsay Everard's pilot for more than three years, has been appointed control officer at Jersey's airport, which is to be opened in a few months time. He is at present taking a control officer's course at Croydon. His successor is F./O. A. H. Hole, R.A.F.O., who was previously with No. 14 (Bomber) Squadron.

Navigational

THE following candidates passed the examination, held in October, for the Second Class Navigators' Licences: Bateman, J. W.; Beale, R. K.; Beresford, R.; Blount, N. A.; Chapman, F. B.; De Satge, M. V.; Derington Turner, C. R.; Duffy, G. F. R.; Emerson, R. K.; Gill, H. W.; Howman, J. F.; Jordan, E. W.; Jones, J. K.; Lewis, E. M.; May, W. S.; McLannahan, G. G.; Middleton, R. B.; Page, R. H.; Pugh, J. B. W.; Robinson, E. G.; Scott, I. A.; Stafford, R. C.; Stewart, W. L.; Walker, J. G.; Williamson, R. J.; Wright, C. F. C.; Younghusband, R. K.

Seventy-four candidates sat. The next examination will be held next week.

Although those licences granted or renewed before January 1, 1937, will not be affected, the maximum period of validity for civil air navigators' licences will, in future, be twelve months.

A Question of Liability

AFTER a hearing which lasted for several days, damages of £10,026 were last week awarded to Mrs. M. M. Fosbroke-Hobbes against British-American Air Services for the death of her husband in an accident at Heston in 1935. Mr. Justice Goddard found that the pilot was negligent. Airwork, Ltd., the other defendants, successfully pleaded that, though the suppliers of the machine, they were merely acting as booking agents.

From the evidence of the pilot, it appears that the tail trimming gear was not, for one reason or another, wound fully forward and the machine left the ground tail heavy and was, in fact, partially stalled until the moment of contact with the ground.

The one bright feature of the whole case was a remark of the judge, who said that, in proportion to the number of civil aeroplanes in use, the number of deaths was astonishingly small compared with deaths caused by cars. "I do not see why," he added, "I should hold that an aeroplane, because it flies, is a thing dangerous in itself."

A Good Friend Misreported

IN the course of a speech in the House of Lords on November 24, the Earl of Halsbury referred to a statement alleged to have been made by Mr. Lester Gardner, the well-known American aviation authority, who recently visited this country, that "In the air England is at least three years behind any Continental nation in construction and design and possible output."

No one of Mr. Gardner's very many friends who read that remark could have thought it anything other than a misquotation, and so it comes as no surprise that he has sent the following cabled statement to the Secretary of State for Air, for publication:—

> "Have just seen Earl of Halsbury's reported quotation of me in House of Lords. Deeply regret unintentional misrepresentation of my opinion, apparently based on misquotation in a New York newspaper on November 6. Same paper corrected this misquotation by printing column interview on November 22 where I stated English aircraft have always been noted for their excellence of design and construction. Unthinkable I could make statement attributed to me disparaging British aircraft development which I so greatly admire."

Civilising Influence

THE Postmaster-General announces that air mail correspondence for Eritrea, Ethiopia, French Somali Coast and Italian Somaliland can be accepted for transmission by Imperial Airways' service to Egypt, and thence by Italian air service.

Incidentally, the Christmas mails carried by Imperial Airways were the heaviest ever despatched from this country. The letters sent on the Australian and African services weighed 22,758 lb.—or about ten tons—as compared with 17,572 lb. for the corresponding Christmas despatches of 1935.

Santa Claus Himself

UNTIL December 22 the inhabitants of North Ronaldshay, the most northerly island of the Orkney group, had been unable to send their Christmas mail and parcels, since for two weeks they had been cut off from communication by sea owing to continuous storms, though the Highland Airways' services has made five calls. When the machine reached the island on that day the anxiety of the people was communicated to the pilot, with a request that he should get in touch with the Kirkwall Post Office. This message was duly delivered, and instructions were eventually forthcoming that Highland Airways should arrange a special charter. A machine went out and collected the Christmas mail from them and from the island of Sanday.

It is interesting to note that during the two weeks Highland Airways' air mail service between Inverness and Kirkwall has operated regularly with the exception of two Kirkwall-Inverness flights, when the head winds were too strong for the return journey to be made before dark.

Looking Forward

IN an article published in a recent issue of an American technical review, Dr. Hunsaker and Mr. Mead speak of "to-morrow's aeroplane" for transcontinental service in the U.S. as one which would carry a total payload of 5,100 lb. including twenty passengers, their luggage, and half a ton of mail, from coast to coast overnight without normally calling on the engines for more than 60 per cent. of their rated power. The machine would be a low-wing monoplane with four two-row radials giving a total of 4,000 h.p., and would have a gross weight of about 40,000 lb., a range of 1,250 miles and a cruising speed of 225 m.p.h. at 10,000 ft.

The all-metal wing would be one of the modern profiles developed by the National Advisory Committee for Aeronautics and, with flaps, the loading would be 24 lb. per sq. ft., giving a landing speed of less than the 65 m.p.h. required by the Department of Commerce. After investigating the possibilities of pusher propellers, the authors feel that the conventional tractor arrangement, affording a propulsive efficiency of 86 per cent. with a propeller-reduction gear ratio of 0.57, is best. Constant-speed propellers would be provided.

The weight of cabin equipment and crew amounts to nearly 12 per cent. of the total weight of the machine, the structure of which accounts for about 26 per cent., the power plant for 23 per cent., and the useful load for about 31 per cent., leaving about 8 per cent. as a margin for variations and additional equipment.

Perhaps the most outstanding improvement in its performance over that of machines in service to-day is the increase in cruising speed and non-stop range obtained without appreciable increase in operating cost. The description, in fact, fits the Douglas D.C.4 "Overweather plane" which is now being built, though, no doubt, all American manufacturers are working on similar lines.

For the less immediate future Messrs. Hunsaker and Mead speak of a wing loading of 40 lb. per sq. ft. By changes in engine design leading to drastic reductions in their frontal area, the nacelles enclosing the engines would be little, if any, larger than the structures required to support the airscrews if the engines were carried within the wings. The machine of the future would look very like those of to-day, but its gross weight for the same payload, range and speed would be some 6,000 lb. less and its direct operating cost would be reduced from 23 cents to 18 cents per ton/mile.

Although meteorological considerations impose limits on high-altitude operation that have not been fully appreciated, there might, nevertheless, be over-all advantages in flying at 25,000 feet, thus avoiding rough air, improving regularity of service, and shortening the time of east-bound flights. Flight at that altitude, however, requires cabin supercharging at additional weight and cost. True stratosphere operation looks promising only for non-stop transoceanic or transcontinental flights.

Topics of the Day

Ground Training

FROM the moment when I first heard of, and saw, the layout of the Kronfeld ground trainer, I thought that the scheme was a good one. It was obvious that a large field or aerodrome, with reasonably open surroundings and lying well away from habitations, would be necessary for the idea to be put into practice, but it was equally obvious that so many hundreds of impecunious enthusiasts would be roped in that, by sheer weight of shillings, such a site would be bought and used.

In the meantime the erstwhile Leicestershire Pou Club has, with the help of Mr. Lindsay Everard, by becoming the County Flying Club and by losing its *Pou* enthusiasm, become something of a power in the land as the first club to attempt this method of training. Any similar club which might have been started in a more densely populated area would have provided a better idea of the potentialities of the scheme.

The principle of the ground trainer was described in *Flight* of September 3, 1936, and its success has been at least partially proved by the fact that, out of half a dozen or so *ab initio* pupils at Leicester, all but one succeeded in carrying out successful straights in a real Drone. The unsuccessful candidate not unnaturally suffered a reverse through the fact that the brand-new sensation of being away from Mother Earth was too much for him. The trainer is only a "kiwi," teaching control effects.

Hence the more advanced version, which will fly, albeit not very powerfully, and can be mended cheaply.

A Possible Danger

SO long as the pupils do not attempt anything more than straights I am all in favour of the advanced version. Its danger lies in the fact that, if it is good enough to leave the ground in the hands of a novice and within the limits imposed by an aerodrome, then the more skilful and courageous pupil will be able to do a little more before finding that it has not enough urge to take him over a rapidly approaching obstacle. If the pupil uses his head and turns back, his lack of experience may cause him to lose all his height during the inevitable sloppy turn, and his down-wind speed will, in any case, tend to upset him.

The point, however, is that he could get himself into far more serious difficulties with the real thing, and the resultant crash would be far more expensive. It is hardly possible, in any case, to smash the flying trainer in a bad landing unless a wing-tip is trailed, and the very exposed position of the amateur aeronaut should act as a deterrent to one who is in any way reckless.

The flying trainer, in fact, *can* be a danger, but some intermediate machine of strong and simple construction was entirely necessary if the scheme was to be carried through without long and expensive "crash pauses." An ability to keep straight with, to the newcomer, the somewhat unnatural foot control, is all that is really necessary in flying a Drone, but allowance must always be made for the development of "height and attitude sense."

During the demonstration at Hanworth last week it was also shown (quite unintentionally) that it is vitally necessary for a Drone club of this kind to have an aerodrome or field all to itself. The pilot, in this case, took the trainer up for a straight, turned through the gap between the Club and General Aircraft, flew *downwind* at zero altitude over the part of the aerodrome used by Flying Training, and reappeared a minute later on the other side of the "island." We were not left to guess what the F.T. instructors and pupils thought of that!

It is all going to be great fun, but if anyone talks about its value for training Ace and Anti-Aircraft Fodder—I shall laugh.

Droning in Luxury

WHEN the Captains, Kings, and Others had departed, I spent a very interesting quarter of an hour or so in the air with a De Luxe Drone fitted with a Carden-Ford engine. Even if this engine makes comparatively little difference to the cruising and maximum speeds—it adds about 5 m.p.h. in each case—the take-off is shorter and the climb considerably better.

This particular machine is the property of a pilot who intends to fly it eventually to South Africa, and for this purpose tanks are fitted which will give a range of 500 miles, despite the added weight of such things as navigation lights.

The A.S.I. readings at low altitude and at various engine revolutions convinced me that there is a distinct position error with the pitot head placed just above the deck in front of the screen. At 3,000 r.p.m. (cruising revolutions) I could not get more than 58 m.p.h. without loss of height, yet there is no doubt in my mind about the accuracy of the 62-65 m.p.h. given as a cruising speed for the type. Despite Mr. Kronfeld's safety-first recommendation that the machine should be glided at 45-50 m.p.h., I found that there was an ample safety margin at 40 m.p.h., which is also the best climbing speed. Probably he was remembering my last effort, with an out-of-work A.S.I., in which I brought the Drone in at, apparently, about 35 m.p.h.; even at this speed everything worked as it should.

Nothing could be warmer and less draughtproof or provide better all-round visibility than the exhaust-heated, enclosed cabin on this particular machine, though such enclosure is really unnecessary in a pusher cruising at 60 m.p.h.

INDICATOR.

FROM the CLUBS

Events and Activity at the Clubs and Schools

MIDLAND

FLYING times for the week ended December 18 were 7 hr. 35 min. dual and 4 hr. 30 min. solo and passenger. The Club has now purchased a Tiger Moth.

SOUTH COAST

The South Coast Flying Club put in 20 hours flying during the week ended December 19, and Miss Kelsey and Mr. R. A. Couchman have passed their "A" licence tests.

PORTSMOUTH

Continuous rain and heavy gales brought down the flying times of the Portsmouth Aero Club to 12 hr. 15 min. during the week ended December 18. Mr. R. C. Manocha has qualified for his "A" licence.

YAPTON

Flying times for December to the 19th totalled 27 hr. 55 min. New members are Mr. E. D. Jack and Mr. B. C. Ling, the latter taking an "A" licence course, while Mr. A. G. Stuart has gone solo after only 4 hr. 50 min. dual.

HERTS AND ESSEX

Flying times for the fortnight ended December 18 amounted to 68 hr. 38 min., there being nine flying days only. New members are Messrs. G. J. Aldous, R. H. Turner and E. Giansant. The competition of the season, flown off during the first week of the month, proved Mr. V. A. Ercolani to be the senior pilot for the year.

SCOTTISH

For the past few weeks Renfrew has experienced the full rigours of a Scottish winter. Gales and fog prevented any flying being done on eighteen days during November, the Club's flying times times amounting to 68 hr. 50 min. A series of talks on aviation subjects is being given by the chief instructor and others. A most enjoyable clubhouse dance was held on December 12.

BROOKLANDS

First solos last week were made by Miss Evans, Dr. Sansom, Major Shearer and Mr. Wigram. New members include Miss Adam, Messrs. Dunphy, Neapean Bishop, K. H. Allen and G. Gallagher, while Miss Friedlander is taking a course of blind flying with Mr. Ken Waller. The new Drone with the Carden engine visited the aerodrome last week, Capt. Davis and Ken Waller both trying it out. On Sunday, December 20, the Club held its annual Christmas dinner, which was attended by seventy members and proved a great success.

REDHILL

For the week ended December 18 flying times amounted to 37 hr. 35 min. A very successful Christmas party was held recently, a hundred guests enjoying the turkey supper and cinema show.

LONDON

The flying time for the week ended December 18 totalled 28 hr. 45 min. Mrs. V. Roberts, Messrs. P. Leborgne, J. Maxwell, J. H. Roberts and J. Stevenson have been enrolled as new members.

SOUTHEND

Owing to better weather conditions flying times for the week ended December 20 were considerably higher. The next landing competition will be held on Sunday, January 3, and a carnival dance is also being held at the Club on Saturday, January 16.

YEADON

Club machines flew 10 hr. 15 min. during the week ended December 18, flights being made to and from Sherburn. A new associate member is Mrs. E. K. Ives, and two new flying members are Messrs. J. and G. T. Rhodes. A dance will be held on Saturday, January 9.

NEWCASTLE-ON-TYNE

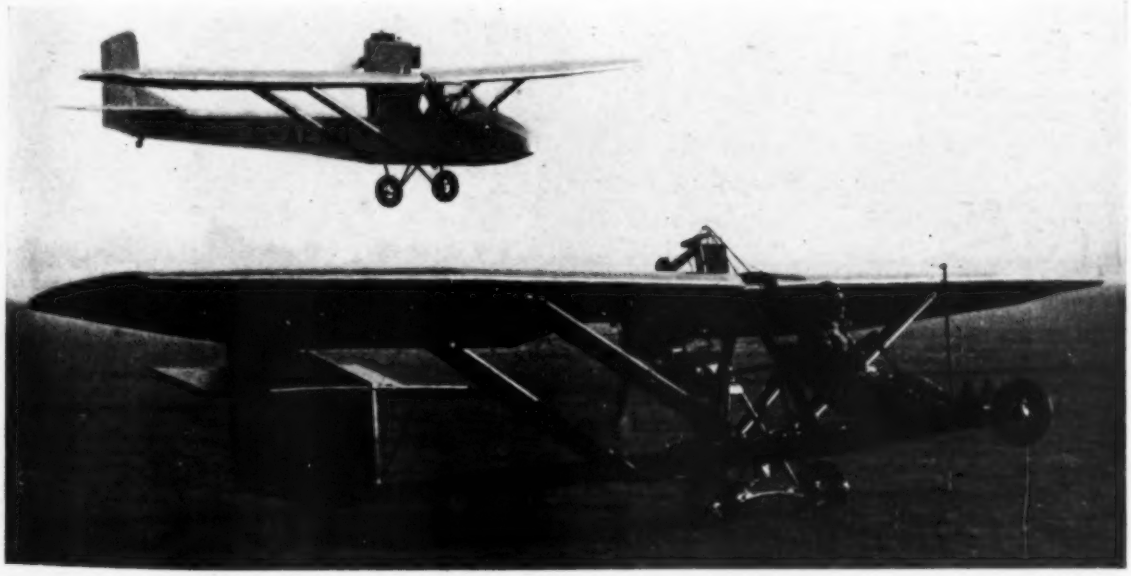
From January 1 to December 18, 1936, a total of 2,130 hours' flying has been put in by the Newcastle-on-Tyne Aero Club. Twenty-seven members obtained their "A" licences, and four their "B's." The Club's annual dinner dance will be held at the Royal Station Hotel, Newcastle-on-Tyne, on Friday, January 22. Tickets can be obtained on application to the hon. secretary.

HANWORTH

For the fortnight ended December 19 flying times amounted to 59 hr. 40 min. Miss G. Neville has joined as a new member, "A" licence tests have been passed by Mr. E. L. Hakansson and Mr. P. O'Neill, while Mr. F. Sagrera has gone solo. The London Air Park Flying Club is holding its annual New Year's dinner and dance to-day, and it is hoped that a large number of members will put in an appearance.

CINQUE PORTS

Mr. L. C. Hilditch went to Hendon recently to undertake his cross-country test flight. This he did with flying colours and returned to Lympne a "B" licence pilot. Mr. Bridger, who has now completed the 100 hr. necessary for a "B" licence, has resold his Moth to the Club and is concentrating on lectures, blind flying, and advanced dual in the Tiger Moth. Mr. W. E. Davis has now returned to Lympne.



UNDERGRADUATION: Mr Kronfeld taxies his new "flying" ground trainer at Hanworth while the latest type of Carden-engined Drone De Luxe flies overhead. Both these machines are dealt with by "Indicator" in his comments on the previous page. The standard De Luxe model costs £325, while the ground trainer is priced at £195. The County Flying Club, of Leicester, charge 9s. an hour for instruction on the normal ground trainer which they have been using successfully for the past month or two. (*Flight* photograph.)

Private Flying

CAMBRIDGE

Flying times at Marshalls' Flying School for the week ended December 20 totalled 28 hr. Flying was impossible for three days owing to high winds. Cross-country flights have been made to Reading and Heston.

C.A.S.C.

Although for the sixth week in succession winds were very high, members flew 11 hr. 30 min. Messrs. Chandler, Leech, Lee, Mitchell, Preston and Cook have taken their initial flights with the Corps. Sir Charles Rose, Bart., of the Porthsmouth Aero Club, has consented to become the Vice-President of the Corps.

NORFOLK AND NORWICH

Weather during the week ended December 19 was rather unfavourable, but in spite of this a number of pilots were able to get into the air. The Club received visits from F/O N. Daunt in a Tiger Moth from Hatfield, and Messrs. H. F. Ramer and W. H. Nock, of the Herts and Essex, who came in a Miles Hawk.

MADRAS

Two flights of considerable importance in India were made in October and November. One was a long tour by a pilot and passenger in the Madras Club's Puss Moth, and the other a flight by the three Club machines from Madras to Allahabad when the foundation stone of the airport building was laid there.

The Puss Moth was flown 4,000 miles by Mr. V. Sundaram, a Club member, from Madras to Bombay, Karachi, Jodhpur, Delhi, Allahabad, Hyderabad and Madras. At Hyderabad Mr. Sundaram's machine joined the three other Club machines—two Gipsy Moths and a Swallow.

ABRIDGE

During the last six weeks the Abridge Flying Club have only had two or three good flying days. Members who are due for their first solos are patiently waiting for the weather to clear.

BENGAL

The Bengal Flying Club put in 23 hr. 40 min. dual and 43 hr. 55 min. solo during the month of November. Mr. Srinibash Banerjee has passed his "A" licence tests, while seven cross-country flights have been carried out.

BORDER

Gales and snowstorms have upset flying instruction so far this month, and only twenty-four hours have been flown. The Club have been fortunate in securing the services of Mr. J. Bell, one of the most experienced engineers in the country, and are now in a position to undertake all types of repair work. G-ABJH has been fitted with a blind-flying hood, and instruction has started.

As is usual when the Club is closed, the weather conditions were ideal during the Christmas holidays. Mr. Beauchamp, touring England in the Hornet over Christmas could not keep out of the fog which was general in the South and Midlands. On the first day he was forced down at York and on the second day in a very small field near Bristol. This field was much too small to allow the machine to be flown out, and the assistance of the Royal Air Force had to be obtained and the machine towed by road to Filton aerodrome. He flew on to Cheltenham, his home town, and returned to Carlisle on Tuesday. Mr. R. S. Hays, the first Carlisle-trained pilot to take his "A" licence, visited the Club during the week and did quite a lot of flying.

Time to Kill?

A "B" licence pilot and holder of a full W/T operator's ticket, Miss M. E. Barnard, B.A., of the Lancashire Aero Club, has recently obtained her medical degree at Cambridge. Some time ago her engagement to Mr. G. F. Yuill, of British Airways, was announced. George Yuill was, until comparatively recently, chief instructor of the Lancashire Club. We are left to wonder what Miss Barnard can possibly do in her spare time.

The Aeronautical Bookshelf

Euphrates Exile, by A. D. MacDonald (G. Bell and Sons, Ltd. 7s. 6d.)

ASIDE of R.A.F. activities about which it is safe to say that nothing has previously been made public in this country is its Intelligence service in Iraq. Mr. MacDonald tells us about it in this book. Briefly he explains that the force behind the Iraq Government (he deals with the period before the Mandate was abandoned) is the Royal Air Force, which, however, belongs to the British Government. The Iraq Government might call for air action in certain circumstances, but the R.A.F. was not prepared to comply until it had received reports on the situation from its own Intelligence officers.

Then Mr. MacDonald proceeds to give his impressions of life on the Euphrates and of the Iraqis whom he met. By his own words he must be classed as one of those optimists who persist in believing that an Asiatic nation can make a success of democracy on the British model. He perpetually met facts which shook his faith, but he refused to let it be shattered—or so he declares. His liking for many Iraqis and his readiness to meet them as man to man are much to his credit, and so is the literary skill with which he gives his impressions. This is a valuable and very attractive book.

War Over England, by Air-Commodore L. E. O. Charlton, C.B., C.M.G., D.S.O. (Longmans, Green and Co., 12s. 6d. net.)

THE first part of this book is a chronicle of the air raids over Great Britain during the Great War. It is not the first chronicle of the sort, or the best. Then the retired Air Commodore plunges into prophecy—would angels dare to tread there?—and tells the history of a future war. All prophecies are apt to degenerate into futilities, and this is no exception. It will suffice to mention two or three, and from them the value of this book may be gauged. At a time of acute international tension it is said that *three-fifths* of the flying personnel disposable for home defence were put out of action by a surprise German raid on Hendon on Display day. After the outbreak of war many of the Territorials of the anti-aircraft units had wandered far afield with their families for the week-end, and could not reach their duty posts. The listening posts of the Observer Corps also failed, for some unexplained reason. When rioting broke out in London, the Guards Brigade was, "unfortunately," at Pirbright for training, and their duties in London had been taken over by two line regiments. "They had neither the experience nor the martial aspect best calculated to deal with such a situation."

This comes well from an ex-officer of the Lancashire Fusiliers! And anyway, what experience have the Guards, despite their martial aspect, in dealing with London riots?

Sky Gipsy, by Claudia Cranston. George G. Harrap and Co., Ltd., 182, High Holborn, London, W.C.1. Price 10s. 6d.

IT would appear that life in Texas has a "snap" in it, but the Texan authoress of *Sky Gipsy* found new adventure and untiring interest in a 300-hour, 25,000-mile airline tour of South and Central America. She tells of her first sensation as the flying boat took off: "... the boat was moving. Or else the sky was sliding. Snow-white spray dashed in uncountable sparkling needlepoints against the window-panes. The boat skimmed over the water, beating up meringue all round it. Faster, faster .... A final quadruple roar! A wall of water, solid, opaque against the windows, shutting out everything! 'I guess we're sinking now,' she shouted at [illegible] lady with the new magazine. 'Ar[illegible]ve never seen [illegible] America!'

"Then everything suddenly emerged into sunshine. The cute little twin lozenge-shaped silver pontoons under the wings of the ship sloped up, dripping like a bird's feet tucked up under its breast."

The many such descriptions, though naïve, show real appreciation of beauty, and an enthusiasm which is contagious.

Jane's All the World's Aircraft, compiled and edited by C. G. Grey and Leonard Bridgman (Sampson Low, Marston and Co., Ltd., two guineas net).

THE deletion of many obsolescent types to which, as the preface points out, the British Aircraft Industry in particular has been loth to say farewell, and more conscientious compression of material, has enabled the compilers of "Jane's" for 1936 to keep down the number of pages while presenting more useful data and illustrations.

The whole work has been approached in the same fashion as in previous years, there being the usual "historical" sections devoted to civil and military aviation in addition to descriptive matter on aircraft and aero engines.

Recently completed high-performance monoplanes enable Great Britain to make a better showin[illegible] than ever in the military field and this, supported by our [illegible]cellent sporting and touring range, compensates in some m[illegible]sure for the comparatively poor display made by our commercial types. Happily foreign students will gather from a perusal of the data relating to British civil types that, whatever our shortcomings in the development of up-to-date commercial aircraft, we have, in the Short Empire boat, for example, one or two models which, in their class, stand head-and-shoulders above their foreign rivals. And they will gather also after reading references to machines like the D.H. Albatross and A.W. 27, that some remarkable rabbits are soon to appear from the national top hat.

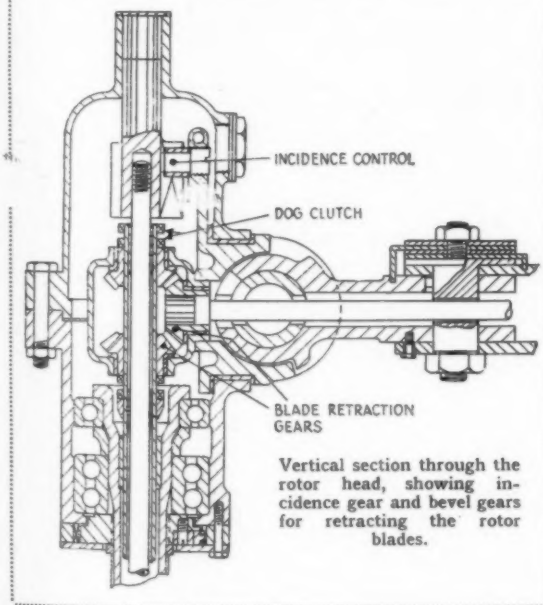
The reappearance of G.A. drawings is welcome.

A NEW CLASS of AIRCRAFT

Aeroplane, Autogiro and Helicopter Combined : High Top Speed a Feature of Cameron Rotor Plane

ATTENTION has been focused once more on the helicopter type of aircraft by the very promising performances attained recently in France by the Breguet-Dorand gyroplane. Since the British Air Ministry's offer of a substantial prize for helicopters died a natural death a good many years ago there has been little activity among British helicopter inventors, and the Autogiro has pretty well held the field with a performance, including "jump-starts," which goes a long way towards that of the helicopter ideal. The ability to hover, in the true sense of the word, is still lacking, however, and a top speed comparable with that of the aeroplane, power for power, does not seem to have been quite attained.

Now comes news from Glasgow, the home of the Weir Autogiro, curiously enough, of a new design which seeks to combine in one aircraft all the attributes, or, at any rate, all the desirable qualities, of aeroplane, Autogiro and helicopter. The aircraft has been aptly named the rotor plane by its inventor, Mr. Peter Cameron; aptly because the craft has both rotating and fixed wings. At first sight

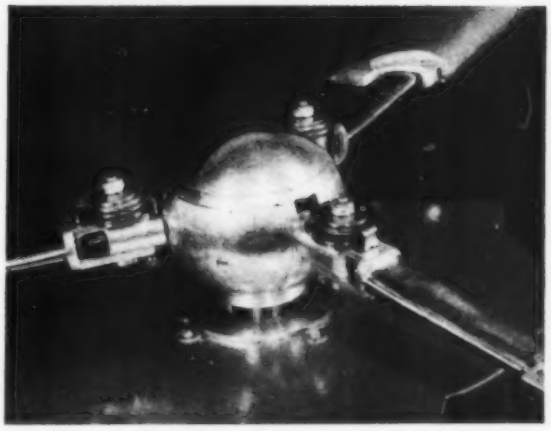


Vertical section through the rotor head, showing incidence gear and bevel gears for retracting the rotor blades.

one is inclined to jump to the conclusion that this combination is a retrograde step, having been abandoned by the late Señor de la Cierva some years ago.

It may be recollected, however, that, before he did away with the wings of the Autogiro for the sake of simplicity of control, Señor de la Cierva was fond of explaining that by carrying a certain percentage of the weight on a fixed wing his rotor was enabled to work at higher efficiency. This is exactly what Mr. Cameron is doing, but with increased effect because he *retracts his rotor blades*.

This is a sufficiently startling statement, but the scheme



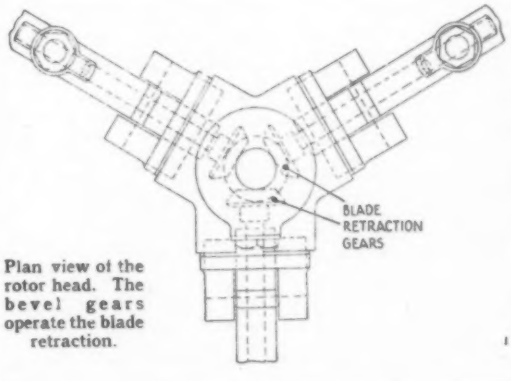
Neatness characterises the external appearance of the rotor head of the Cameron rotor plane, here shown in model form. The blades can be folded for storage.

evolved by Mr. Cameron bears every sign of being workable. On a large scale model, in which the rotor is driven by an electric motor, the retracting mechanism is represented, and it certainly works very well. It may be argued that many a variable-pitch airscrew mechanism has worked perfectly on a model and fallen down when tried full-scale, but Mr. Cameron is an engineer and has gone into the subject very thoroughly, and his own calculations have been checked by expert stress people, who confirm his conclusions. The power required to retract the blades is but a small fraction of the power of the rotor. That required to extend the blades is, of course, even smaller, as it is helped by centrifugal force.

The hollow spar of the rotor blade contains a screw which terminates at its inner end in a bevel gear wheel. Meshing with this are two other gears, one above and one below. By operating one or other of two dog clutches the gear on the screwed rod is rotated to increase or decrease the diameter of the blade. For take-off and climb the blades are extended to give a maximum of lift, while for cruising they are partly retracted and for top speed fully retracted.

Variable Incidence

"Jump-starts" are, of course, possible with the Cameron rotor plane. The mechanism of the rotor head includes provision for varying the incidence of the rotor blades. This can be done suddenly, for making a "jump-start," or gradually while the aircraft is actually flying. With the combinations possible between rotor diameter and rotor



Plan view of the rotor head. The bevel gears operate the blade retraction.

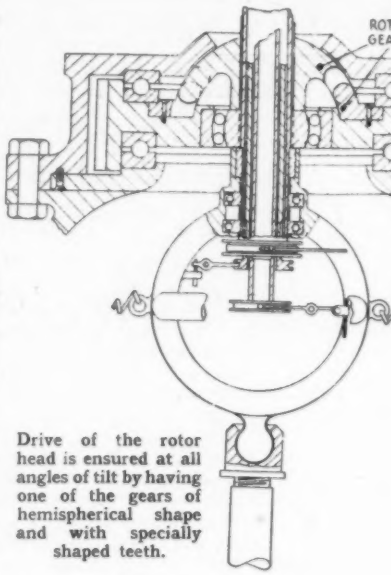
blade angle incidence, it will be gathered that settings can be chosen to suit any conditions of flight.

When the rotor plane is used as a helicopter, it will be obvious that the simple single rotor-cum-fixed-wing arrangement is not in itself sufficient to enable the machine to hover. Means have to be provided for preventing the whole aircraft from rotating around its vertical axis in a direction opposite to that in which the rotor is being driven. Mr. Cameron has disclosed to *Flight* two ways in which that can be achieved, both of which seem perfectly feasible.

For driving the rotor direct, as in "jump-starts" or when "helicoptering," Mr. Cameron employs a very ingenious gear arrangement. The crown wheel on the rotor spindle is of hemispherical shape and has specially shaped teeth to ensure proper engagement with the gear on the transmission shaft at all angles of tilt of the rotor head. There is, of course, a clutch incorporated in the drive, and as the incidence mechanism of the rotor blades is controllable during flight it is possible to change the nature of flight from autorotative to mechanically driven at any time.

Thus it will be seen that the Cameron rotor plane combines all possible forms of heavier-than-air flying. It can take off with a run, like an aeroplane, or it can make a "jump-start," or it can rise vertically as a helicopter. When the desired height is reached it can fly almost entirely as an aeroplane with very heavy wing loading, the rotor blades retracted and set at small incidence so as to make the wing carry most of the weight. It can fly as an Autogiro, with the rotor being windmilled; and it can, with the aid of means which cannot yet be disclosed, fly as a helicopter, hover, rise, and descend vertically.

The only argument against the wing-rotor combination that has occurred to us so far is that the wing will, presumably, act as an aerodynamic "damper" during a "jump-start," and may slightly reduce the height of the jump. That may not be a very serious objection. For fast flight, apart from the advantages of the retractable rotor, the fixed wing is probably a help rather than a hindrance in that it does make possible the use of a retractable undercarriage. It seems unlikely that the drag of a good wing is much greater than that of a wide-track undercarriage with very long struts, especially in view of the fact that the wing can be heavily loaded and can thus fly much closer to the maximum L/D angle than does the normal aeroplane wing.



Drive of the rotor head is ensured at all angles of tilt by having one of the gears of hemispherical shape and with specially shaped teeth.

Altogether, the Cameron rotor plane appears to represent a serious attempt to combine in the most logical manner possible the best features of all existing aircraft classes, and it is very much to be hoped that its designer will find the support necessary to carry his invention through its development period.

Correspondence

(*Concluded from page* 696)

respect, thereby invalidating the theory? Or can it be that the low scale of the test completely invalidates the "careful analysis"? He cannot have it both ways! Indeed, he naively admits that "one should not place too much importance on this fact in view of the small order of the difference and the influence of possible errors." Apart from which one is asked to believe that a 1925 wind-tunnel operating at a R.N. of less than half a million could produce minimum profile drags ranging from 0.0086 to 0.0095, results which are of the same order as those of full-scale tunnels to-day. Now, apparently, if Göttingen could do this in 1925, the Americans are wasting a mint of money with their present research equipment.

The question of drag, however, is of secondary importance to that of lateral control and tip stalling, and a closer reading of my original letter will show that I advocated full-scale pressure distribution experiments in order to extend our knowledge of flow characteristics, especially at high angles, in the region of the aileron span. Because a systematic attack on tapered wing characteristics must start somewhere, I suggest beginning with the elliptical form because of its fundamental importance in the theory, rather than to investigate purely arbitrary plan forms whose basic properties are likely to be masked by unknown induction corrections.

Obviously there are no mysterious qualities inherent in a particular plan form, but if the elliptical form results experimentally in coincident burbling across the span, as predicted by theory, then it appears to me as the best behaved member of the family, so far as stalling phenomena are concerned. Furthermore, the adoption of a standard plan form would eliminate (*pro tem*, at any rate) the unsatisfactory idea of "taper ratio" from the picture, thus leaving the investigator free to concentrate on the many other parameters.

But perhaps, after all, the most "rational reason" for such research would be Dr. Lachmann's letter itself, with its faith in the results of 1925 and a Reynolds number of less than half a million. After some twelve years, when designers in all the leading countries are now actually producing elliptical wings in full-scale (*e.g.*, Heinkel and Dornier in Germany, Dewoitine in France, Douglas and Seversky in the States, and Supermarine's in this country), we are asked to fall back on the evidence of an isolated Göttingen test and the analytical work of Glauert published in 1926. Surely such a confession of antiquity is a complete vindication of my charge of scientific blindness.

In the realm of the æsthetic Dr. Lachmann and I undoubtedly differ, for I have yet to see anything "aerodynamically superior" which was not *invariably* "pleasing to the eye." Aerodynamically, at any rate, I have shown that I keep excellent company, so if the elliptical wing is a "fetish" I can only hope that my fellow sorcerers will eventually bewitch even the ramparts of Cricklewood itself.

STANLEY H. EVANS.

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AERONAUTICAL PATENT SPECIFICATIONS.

(The numbers in brackets are those under which the Specifications will be printed and abridged, etc.).

(*Published, December* 31, 1936.)

15852. RUBBRA, A. A., and DOREY, R. N.: Hydraulic controls for retractable undercarriages of aircraft (457,709).
16464. UNITED AIRCRAFT CORPORATION: Control mechanism for propellers or the like (457,808).
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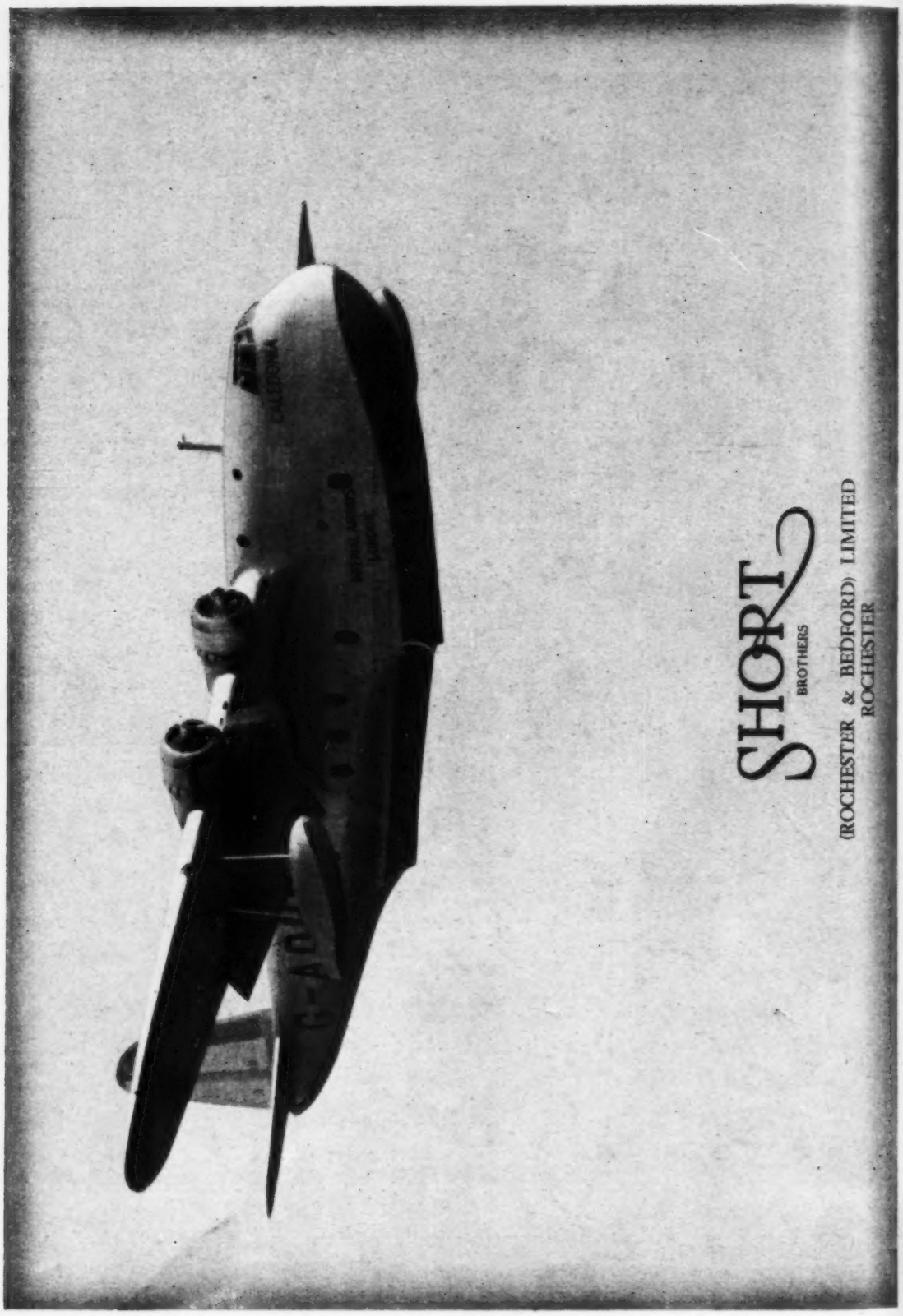
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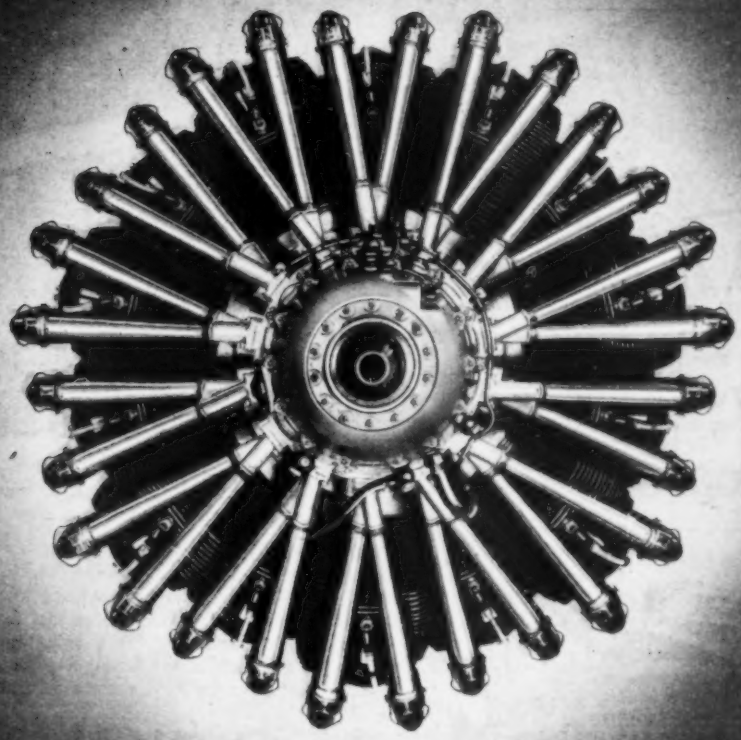

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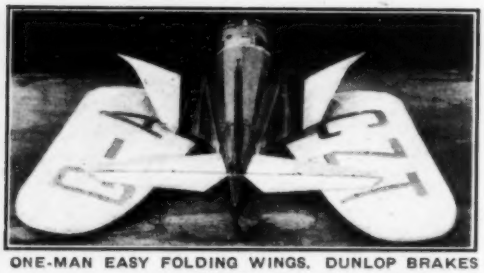

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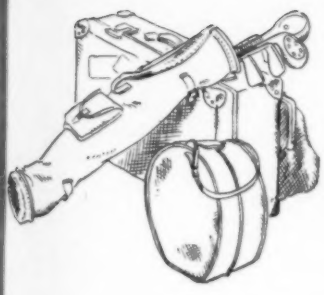

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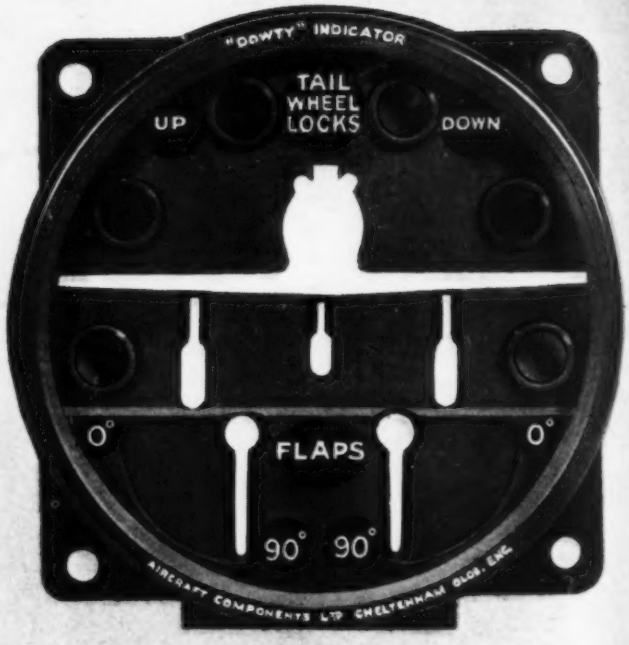

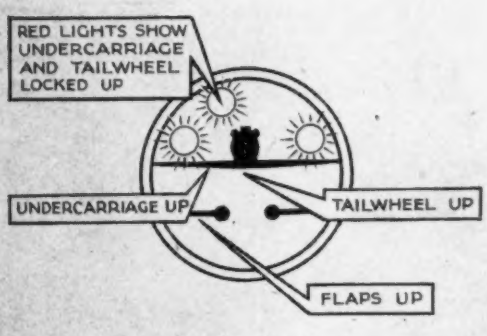

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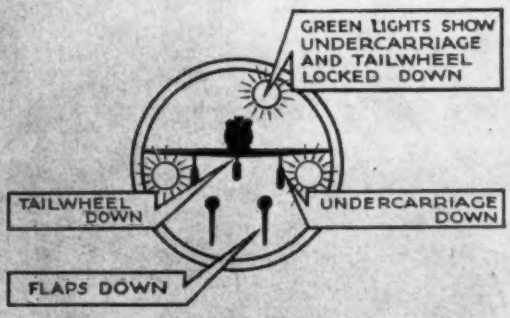
When undercarriage and tail wheel are retracted the models on the dial are hidden and red lights show they are locked in the 'up' position. When flaps are raised the indicator shows them in the 'up' position.



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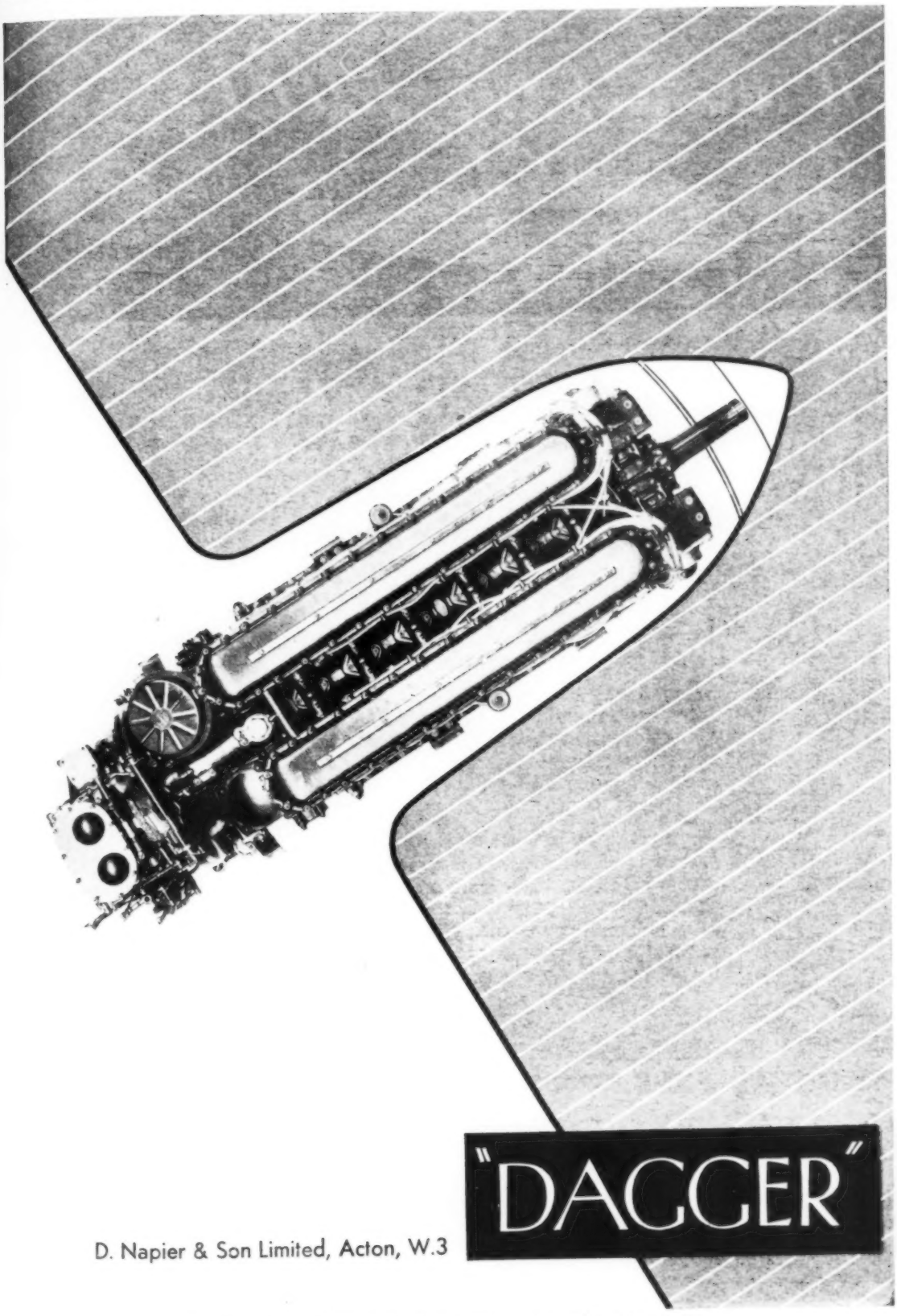

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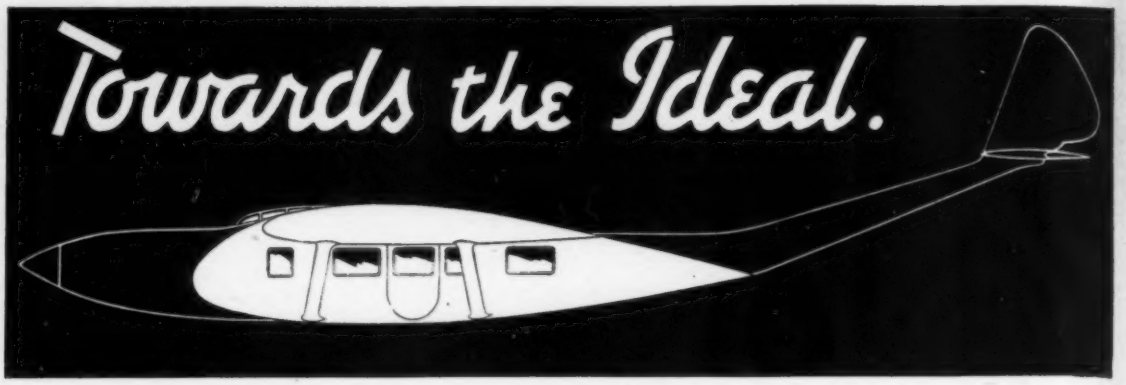

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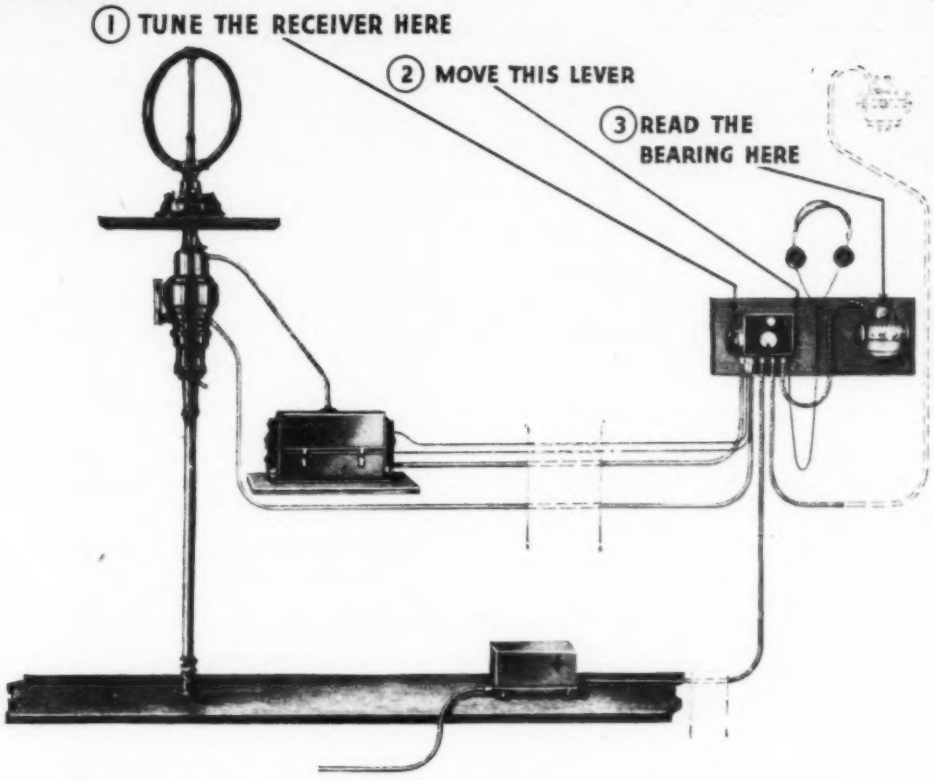

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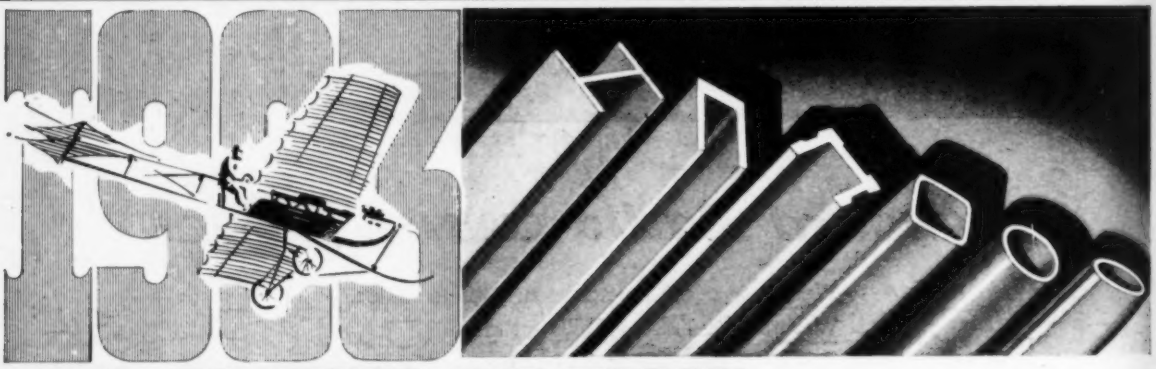

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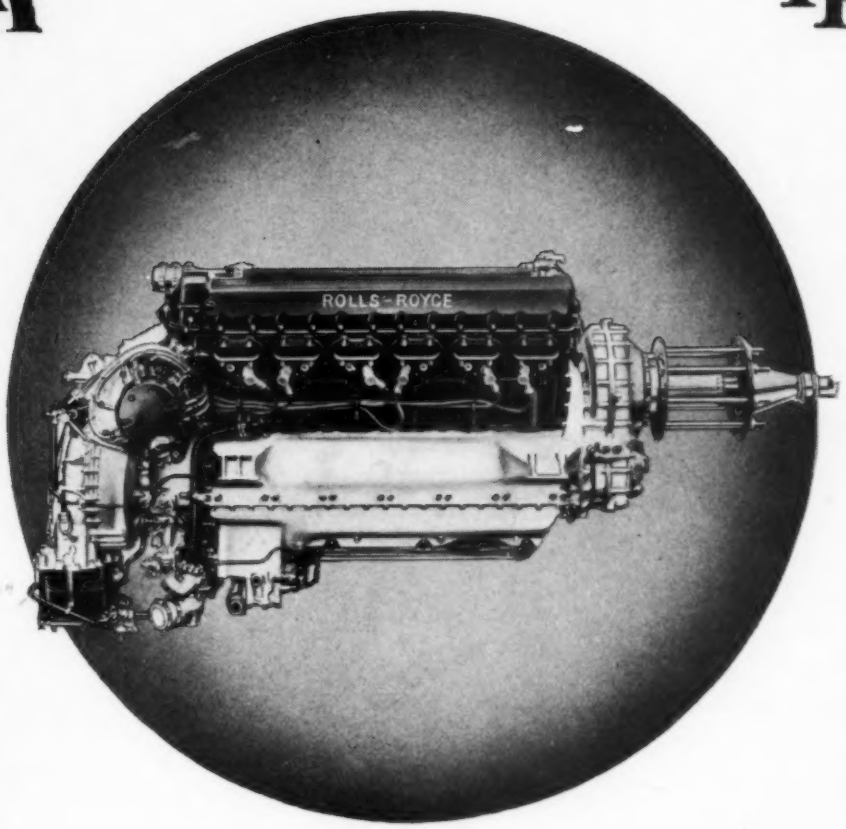

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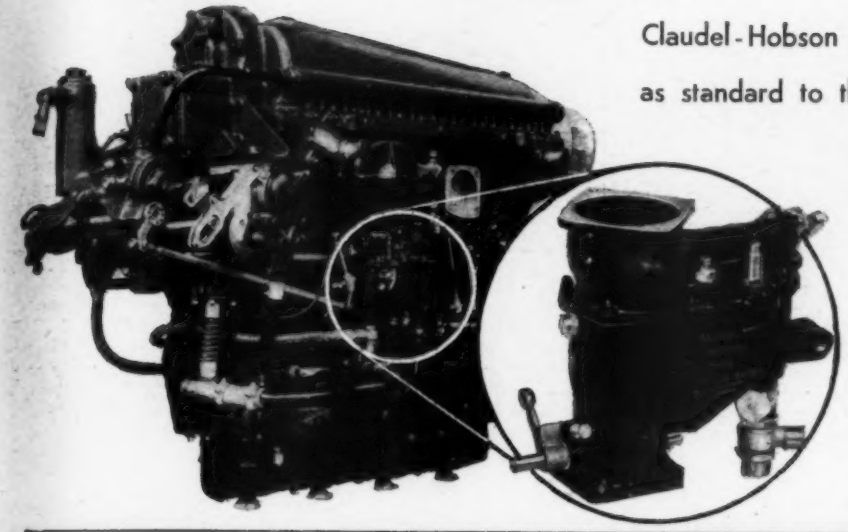

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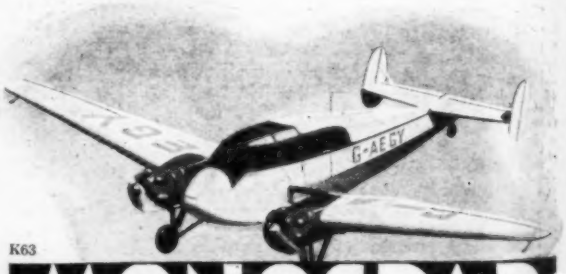

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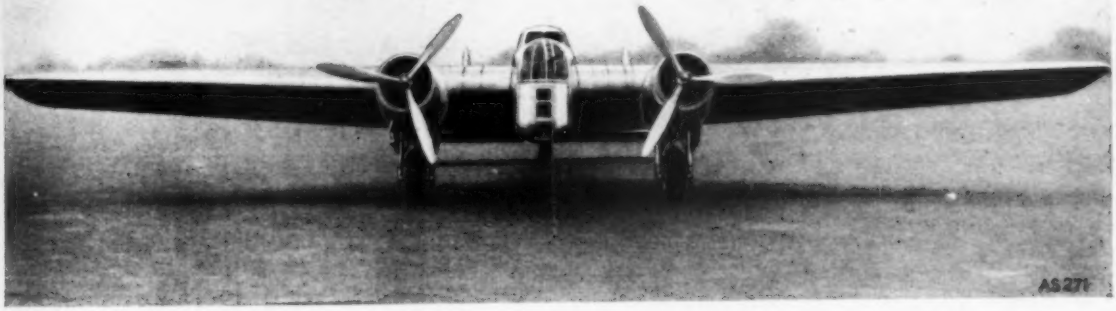

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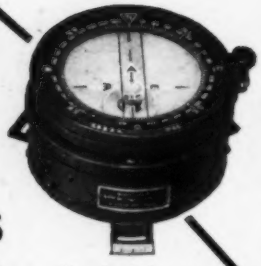

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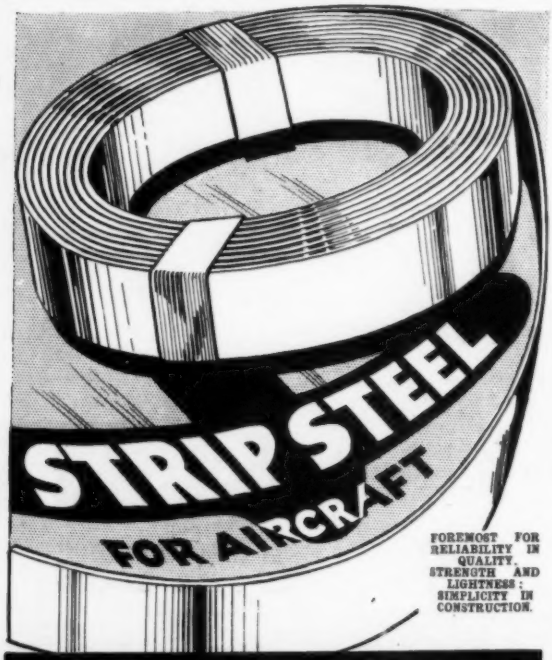

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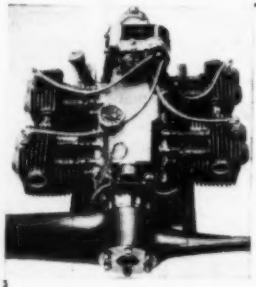
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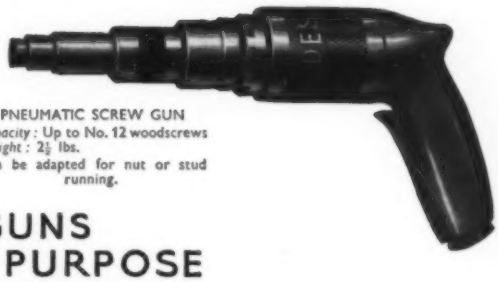

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